



# FBI

LABORATORY  
2006



THIS IS A  
STICK-UP  
WILL KILL



## Message from the FBI Laboratory Director

Dr. Joseph A. DiZinno

Exemplary service has always been the primary goal of the FBI Laboratory, and in 2006, FBI Laboratory Division employees recommitted themselves to providing the highest quality forensic response and analysis services to our “customers”—the local, state, and federal intelligence and law enforcement agencies that use FBI Laboratory services.

The FBI Laboratory supports local, state, and federal law enforcement and intelligence agencies in terrorism and criminal investigations. Much of our work occurs off-site: Laboratory employees respond to crime scenes to perform such tasks as searching for victims, gathering evidence, taking photographs, or providing much-needed support and assistance at the scene. The backbone of the Laboratory, however, is a cadre of educated, experienced, and qualified forensic examiners who assist investigators in their efforts to bring criminals to justice while providing closure to victims and their families.

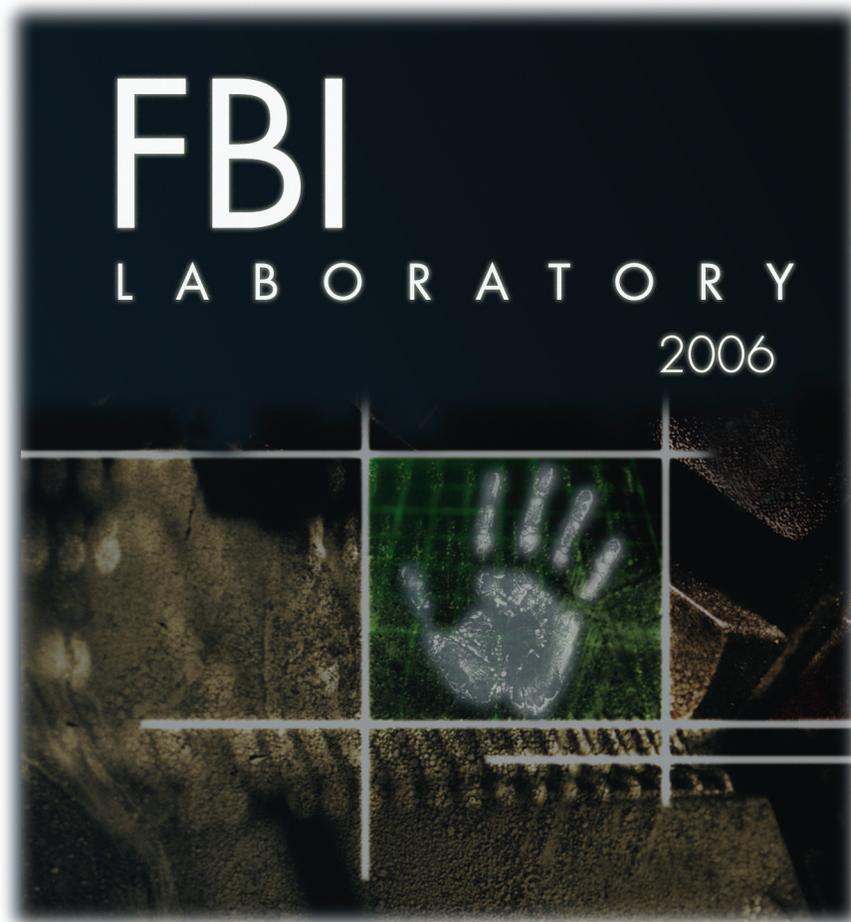
At the same time, in keeping with the FBI’s primary mission of preventing terrorist attacks, the FBI Laboratory examines literally hundreds of thousands of pieces of evidence through the Terrorist Explosive Device Analytical Center (TEDAC). The TEDAC is a multiagency effort that employs personnel from law enforcement, military, and civilian agencies and whose work touches numerous units in the Laboratory, including the Evidence Control, Explosives, Latent Print, DNA, Firearms-Toolmarks, and Trace Evidence Units. The analyses performed on TEDAC evidence now represent the Laboratory’s primary and most demanding caseload.

In 2006 the Laboratory implemented a new quality management system and is working toward renewing its accreditation through the American Society of Crime Laboratory Directors/Laboratory Accreditation Board (ASCLD/LAB). Under the new quality system, the FBI Laboratory will seek accreditation under the ASCLD/LAB-*International* Program, which is based on internationally recognized standards. The *International* Program contains more stringent criteria than the original accreditation program and places a greater emphasis on customer service.

The American people expect their intelligence and law enforcement agencies to protect and to serve them. The FBI Laboratory remains committed to the highest quality service for its intelligence and law enforcement agency customers in order to support their ongoing efforts to keep America safe.

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The FBI Laboratory 2006 Report  
may also be viewed online at  
<http://www.fbi.gov/hq/lab/labannual06.pdf>

# Table of Contents



## Message from the FBI Laboratory Director

<b>Investigative Services</b> .....	3
Chemical-Biological Sciences Unit .....	3
Chemistry Unit .....	5
Combined DNA Index System Unit .....	8
Cryptanalysis and Racketeering Records Unit .....	11
DNA Analysis Unit I .....	13
DNA Analysis Unit II .....	14
Automated Analysis .....	14
National Missing Person DNA Database .....	15
Regional Mitochondrial DNA Laboratory Program .....	15
Firearms-Toolmarks Unit .....	15
Latent Print Operations Unit .....	16
Latent Print Support Unit .....	17
Photographic Operations and Imaging Services Unit .....	18
Questioned Documents Unit .....	19
SoleSearcher .....	20
Special Projects Unit .....	22
Terrorist Explosive Device Analytical Center .....	25
Trace Evidence Unit .....	25
<b>Response Services</b> .....	27
Explosives Unit .....	27
Evidence Response Team Unit .....	28
Human Scent Evidence Team .....	29
Hazardous Materials Response Unit .....	31
<b>Research and Development Services</b> .....	33
Counterterrorism and Forensic Science Research Unit .....	33
<b>Administrative and Support Services</b> .....	37
Administrative Unit .....	37
Evidence Control Unit .....	38
Facility Services Unit .....	39
Planning and Budget Unit .....	40
Security Team .....	40
INNOVARi .....	41
<b>Quality Services</b> .....	42
Quality Assurance and Training Unit .....	42
<b>Community Service</b> .....	44



## Investigative Services

The units described in this section have a primary mission of supporting FBI investigations. Most of the units analyze evidence obtained from crime scenes and major incidents, including plane crashes and natural disasters. Other units support FBI casework by providing photographic services or creating models and exhibits that can be used to conduct an investigation, support courtroom testimony, or plan an event. Some of the units maintain databases that help the FBI and other law enforcement agencies solve crimes, identify missing persons, and exonerate the innocent.

### Chemical-Biological Sciences Unit

The Chemical-Biological Sciences Unit (CBSU) was created to enhance the FBI's ability to conduct and direct forensic analyses of hazardous chemical, biological, and radiological evidentiary materials resulting from terrorist acts involving the use of weapons of mass destruction (WMD). Critical to the success of this mission are the development and validation of methods to analyze threat agents and establish a thoroughly vetted supporting laboratory network that provides a wide range of analytical capability and expertise.

CBSU's Biology, Chemistry, and Nuclear Programs have developed analytical methods that identify and characterize biological pathogens and toxins, hazardous chemicals, and radiological and nuclear materials. CBSU's research and development efforts focus on the validation of existing pathogen identification assays, the development and evaluation of novel molecular and genetic methods for characterizing biological agents, and the identification of trace compounds in evidentiary samples.

CBSU has formalized partnerships with a variety of government, academic, and private laboratories to conduct very specific examinations of FBI evidence. These partner agencies include:

- Lawrence Livermore National Laboratory, Livermore, California.
- Sandia National Laboratories, Albuquerque, New Mexico.
- The Naval Medical Research Center, Silver Spring, Maryland.
- The Savannah River National Laboratory, Aiken, South Carolina.
- The U.S. Air Force Technical Applications Center, Patrick Air Force Base, Florida.
- The U.S. Army's Edgewood Chemical Biological Center, Aberdeen Proving Ground, Maryland.
- The U.S. Army Medical Research Institute of Infectious Diseases, Fort Detrick, Maryland.
- The U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Riverdale, Maryland.

- The U.S. Department of Agriculture, Food Safety Inspection Service, Office of Public Health Science, Eastern, Midwestern, and Western Laboratories.
- The U.S. Department of Homeland Security's National Bioforensic Analysis Center, Fort Detrick, Maryland.
- The U.S. Environmental Protection Agency, National Enforcement Investigations Center, Lakewood, Colorado.
- The U.S. Food and Drug Administration, Forensic Chemistry Center, Cincinnati, Ohio.

CBSU also has developed a Hazardous Evidence Analysis Team (HEAT), a group of experienced FBI Laboratory examiners and technicians who receive advanced training to work with hazardous evidence (chemical, biological, and radiological evidentiary materials too hazardous to be handled at the FBI Laboratory in Quantico). The HEAT has more than 60 active members from 12 separate units within the FBI Laboratory, including CBSU, the Chemistry Unit, both DNA Analysis Units, the Explosives Unit, the Firearms-Toolmarks Unit, the Hazardous Materials Response Unit, both Latent Print Units, the Photographic Operations and Imaging Services Unit, the Questioned Documents Unit, and the Trace Evidence Unit.



*Hazardous evidence analysis of radiological material at the Savannah River National Laboratory*

Examinations of hazardous evidence are conducted at FBI partner laboratories. The HEAT has designated laboratory space at the Savannah River National Laboratory and Lawrence Livermore National Laboratory to work with radioactive evidence. Infectious or biologically contaminated evidence analysis is conducted at the National Bioforensic Analysis Center. Chemical weapons analysis is conducted at the Edgewood Chemical Biological Center.

CBSU continues to coordinate with the FBI's partner laboratories to secure additional laboratory facilities to use for the forensic analysis of WMD materials. In November 2006 the FBI Laboratory and the Savannah River National Laboratory held a ribbon-cutting ceremony for the Radiological Evidence Analysis Laboratory Suite (REALS). The suite provides forensic laboratory space where radiologically contaminated items can be examined by the HEAT. The preparation and deployment of dedicated space at Lawrence Livermore National Laboratory also has been completed.

Construction has begun on the Sample Receipt Facility at the Edgewood Chemical Biological Center. The facility—which is funded jointly by the Department of Homeland Security, the Army, and the FBI—will provide facilities for the safe handling of chemical and biological weapons materials, forensic examination of contaminated evidence, and analysis of chemical weapons compounds. Completion is scheduled for summer 2008.

In 2006 CBSU's Chemistry Program developed and validated an analytical method for the attribution of spore-related material. A novel procedure was created using state-of-the-art instrumentation and appropriate recommendations from the Scientific Working Group on the Forensic Analysis of Chemical Terrorism (SWGFACT). Evidentiary material was analyzed by CBSU personnel in direct support of the FBI's investigation into the 2001 anthrax mailings.



*Anthrax powder from letter mailed to the New York Post*

Personnel in the Biology Program oversaw the forensic analysis in several FBI cases involving the extraction of the toxin ricin from castor beans. Samples were sent to partner laboratories to characterize the ricin present in the samples. In support of the FBI's anthrax investigation, the Biology Program continued to develop and validate a number of molecular assays designed to detect specific differences within the DNA of anthrax that could be used as a comparison to other collected samples. These assays were then applied to evidentiary samples, which have provided useful information to field investigators in their quest to find the source of the material.



*Whole beans, shells, and husks from castor beans*

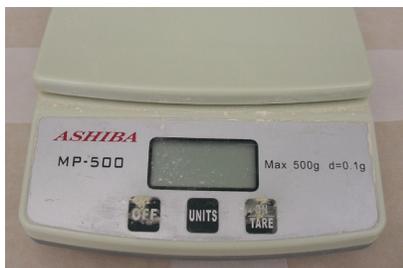
CBSU's Nuclear Program coordinated the forensic analysis of radiological evidence in several FBI cases, which included collaboration with international law enforcement agencies. The partnerships CBSU establishes with other agencies have a far-reaching effect in the communities they serve. As the FBI and its partner agencies increase their knowledge of hazardous materials, these substances pose less of a threat to the world around us.

## **Chemistry Unit**

The Chemistry Unit may be one of the most diverse units in the FBI Laboratory. The unit is composed of five subunits: the General Chemistry Subunit, the Paints and Polymers Subunit, the Toxicology Subunit, the Metallurgy Subunit, and the Instrument Operation and Support Subunit. Each subunit is staffed with personnel who have specialized, formal education and training. The staff examines a wide array of substances, including writing inks, lubricants, self-defense sprays, paint, adhesives, tapes, dyes from bank security devices, drugs and poisons in biological specimens, metals for elemental composition, and structural materials for failure analysis. The unit also identifies unknown substances and conducts investigations involving commercial product tampering. The unit maintains approximately \$6 million worth of analytical instrumentation in order to offer these vast services to its customers. The diversity of the Chemistry Unit is reflected in the variety of cases worked in 2006.

## Caribbean Cartel

A long-running investigation of a Caribbean-based drug-trafficking organization resulted in the arrest of several individuals in the Washington, D.C., area over the past few years. Various items of evidence seized from the subjects were submitted to the Laboratory for analysis. In response to a series of submissions made during the period 2004–2005, the Chemistry Unit



*A coffee grinder and digital scale used by the defendants in their drug operation*

examined numerous items (including digital scales, coffee grinders, microwave ovens, and trash) for the presence of drug residues. Testimony regarding the identification of cocaine and heroin residues on the seized items was presented at trial in district court in Washington, D.C., in March 2006. The defendants in the case were found guilty and sentenced to life in prison.

## Murder in Baton Rouge

Michelle Sparks, 17, disappeared from her Erwinville, Louisiana, home on October 22, 2004, while doing chores. The local FBI field office helped West Baton Rouge Parish sheriff's deputies search for the teen. Her body was found two weeks later in a nearby canal, wrapped in carpet and badly decomposed. The cause of death was blunt-force trauma to the head. An anthropologist at Louisiana State University recovered black material from fractured areas of the victim's skull. This black material was submitted to the Laboratory's Chemistry Unit for examination, along with paint from the suspected murder weapon—the head of a shovel. The black material was examined and identified as paint. It was also visually and chemically consistent with paint from the head of the shovel submitted for comparison. In March 2006 a Chemistry Unit forensic examiner testified to these results in the subject's murder trial. The subject was convicted of second-degree murder with the mandatory penalty of life without the possibility of parole, probation, or suspended sentence.

## Mivacurium Murders

In February 2001 several unexplained deaths occurred at Nocona Regional Hospital in Nocona, Texas. In that same time frame the hospital noticed that several vials of mivacurium chloride, a strong paralytic drug, were missing. The local FBI field office immediately assisted in this investigation, and a suspect was developed. The Chemistry Unit was contacted to aid in the mivacurium analysis. At the time the Laboratory did not have a method to analyze this drug or its metabolites.

The Chemistry Unit quickly developed and validated a method for mivacurium analysis. Initial work on the evidence was directed toward identifying residues of the drug in syringes, intravenous tubing, and empty vials. When this evidence was found to be positive for the drug, the task turned toward the analysis of 10 exhumed bodies submitted in the investigation. When traces of mivacurium were identified in all 10 bodies, the deaths were reclassified from natural causes to homicide. A nurse suspected of injecting the victims with mivacurium eventually pleaded guilty to the charges. In October 2006 she was sentenced to life in prison.

## Carjacking Case

In May 2006 an attorney in Birmingham, Alabama, reported that she had been kidnapped, forced to withdraw funds from her bank account, and then taken to a crack house by the suspect so that he could buy crack cocaine. She further reported that she had been bound and raped while at the crack house. The victim also said that the suspect had blown crack cocaine smoke in her face at least five times to force her to inhale the drug. The suspect in turn claimed that the sexual contact was consensual and that he and

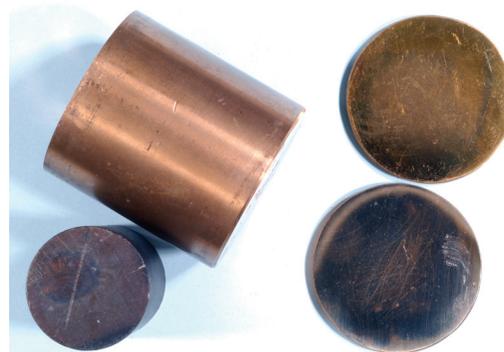
the attorney had smoked crack cocaine together on several occasions prior to the incident in question. The Chemistry Unit was asked to analyze hair from the victim to determine if she was a habitual drug user, as suggested by the suspect.

The FBI Laboratory continues to strive to improve its analytical methods. Even though the Chemistry Unit has analyzed samples for cocaine for almost two decades, the unit viewed this request as an opportunity to improve its method in order to find even lower amounts of cocaine in hair than it previously had been able to find. After a thorough validation of the improved method, the Chemistry Unit tested the victim's hair sample. The results indicated that the attorney did not have a history of long-term cocaine use. Because of these findings, the suspect was federally charged and found guilty on three counts, including carjacking and possession of a deadly weapon while committing a felony.

### **Phoenix Metals U.S.A. II**

As the price of gold and other precious metals increases, a dramatic increase typically occurs in the number of fraudulent schemes developed to defraud investors. Accordingly, the FBI has been increasingly focused on these types of crimes.

In one such case, a shell company doing business as Phoenix Metals U.S.A. II began offering investors the opportunity to invest in a proprietary process the company claimed could economically extract precious metals from volcanic ash. The company set up a sham mining operation at an extinct volcanic site in the Nevada desert and began to convince people to invest in its schemes. Investors were further convinced after being shown metal bars reputed to be dore metal. Commonly obtained as a by-product of copper refining, dore is a mixture of silver, gold, and other precious metals. Ultimately, those misled into investing in the project lost millions of dollars.



*Typical examples of the "precious metal" samples seen in such investigations. The objects are actually brass and other base metals.*

The FBI Laboratory was asked to assist in this investigation and a number of other related precious-metal scams. Alleged dore bars were provided for analysis of their precious-metal content. The Chemistry Unit analyzed the bars and determined that they contained only trivial amounts of silver with little to no other precious-metal content. Interestingly, the analysis showed that the base-metal content of copper and iron in the bars exceeded the value of any precious metals present. Similarly, it was established through an independent expert that volcanic ash does not contain economically useful levels of precious metals.

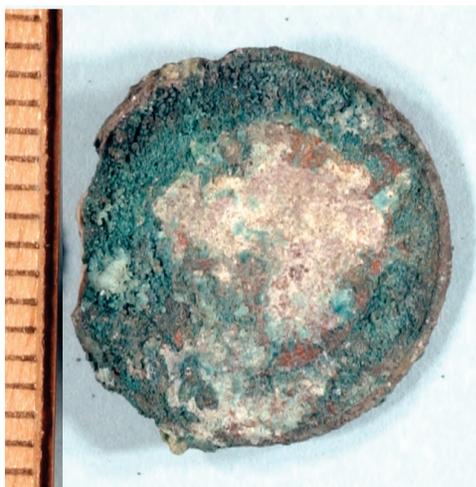
The principal subject of the investigation was convicted in a federal trial in Las Vegas in May 2006 and is now serving a lengthy prison term. In addition, the government seized assets from the company worth more than \$5.5 million.

### **Flash Act**

In the course of an investigation in the New York area, the FBI excavated the concrete foundation of a Brooklyn parking garage. The remains of an individual were found buried under the garage floor. The individual was believed to be Israel Greenwald, a jeweler who had been reported missing two decades earlier. The excavation also revealed a number of small corroded lumps of metal. At the request of investigators, these items were forwarded to the Laboratory for identification.

The Chemistry Unit analyzed the metallic lumps to reveal that they were the remains of a wristwatch, pocket change, and a New York City subway token. Restoration of the subway token determined that it was a type last accepted by the New York City subway system on January 1, 1986. The brand and manufacturer of the watch were also established at the investigator's request.

In April 2006 two retired New York City police detectives were convicted in a federal trial on numerous charges stemming from the investigation, which determined that the detectives were working for a New York organized crime family.



*Corroded subway token  
a) as recovered*



*b) partially restored*



*c) exemplar token*

## Combined DNA Index System Unit



In September 2006 Timothy William Brown, an inmate at the Corcoran State Prison in San Jose, California, was literally hours away from being paroled when DNA testing linked him to the 1979 rape and murder of Virginia Correa. Twenty-seven years after Correa's murder, her family may finally have closure on this case, thanks to the Combined DNA Index System (CODIS).

The FBI Laboratory's CODIS Unit directs both the CODIS Program and the National DNA Index System (NDIS). The CODIS Program allows forensic DNA laboratories to store, maintain, and search DNA profiles from crime scenes, offenders, and missing persons. The CODIS Unit provides to partner agencies the CODIS software as well as enhancements, support, training, help-desk services, and a yearly national meeting for all CODIS administrators. International law enforcement laboratories also may receive CODIS software to help them establish a DNA database program. Forty law enforcement laboratories in 26 countries now have the CODIS software.

CODIS's three-tiered hierarchy of databases includes the NDIS, which is the highest, followed by the State DNA Index System (SDIS) and the Local DNA Index System (LDIS). There are currently 178 NDIS-participating sites consisting of 126 local laboratories and 52 state laboratories, including the FBI Laboratory and the U.S. Army Criminal Investigation Laboratory. The NDIS contains DNA profiles contributed by participating federal, state, and local forensic DNA laboratories and currently contains more than 4 million profiles of offenders, crime scenes, and missing persons.

The success of CODIS depends on maintaining a database of a state’s convicted offender profiles and using it to solve crimes for which there are no suspects. Today all 50 states have laws requiring that offenders convicted of sexual offenses and other violent crimes provide DNA samples. These DNA samples are analyzed and entered into the state and national DNA databases.

CODIS uses several indexes to generate investigative leads in cases where biological evidence is recovered from the crime scene. The Offender Index contains profiles of individuals convicted of felony offenses and other crimes and also includes profiles of arrested persons if state law permits such collection. The Forensic Index contains DNA profiles developed from crime scene evidence, such as semen stains and blood. There are also three missing-person-related indexes. The Relatives of Missing Persons Index contains DNA samples voluntarily contributed from the relatives of missing persons and is searched against the Unidentified Human Remains Index and the Missing Persons Index.

When a DNA profile of a suspect is developed from crime scene evidence, the laboratory searches the DNA profile against the Forensic and Offender Indexes. If a match occurs in the Offender Index, the laboratory will confirm the sample and release the identity of the suspected perpetrator. If a match occurs in the Forensic Index, the laboratory has linked two or more crimes, and the law enforcement agencies involved in the cases can pool investigative information and resources. The chart below depicts how the CODIS system works.

Forensic to Forensic	Convicted Offender to Forensic	Missing Persons
Matches between samples in the Forensic Index can link crime scenes together, possibly identifying serial offenders. Based on a match, agencies in multiple jurisdictions can coordinate their respective investigations and share leads developed independently.	Matches between a forensic sample and the Offender Index provide investigators with the identity of a perpetrator. After CODIS identifies a potential match, qualified DNA analysts in the laboratories contact each other to validate or refute the match.	Combines the use of nuclear DNA with mitochondrial DNA to identify or match biological specimens in cases of missing persons.

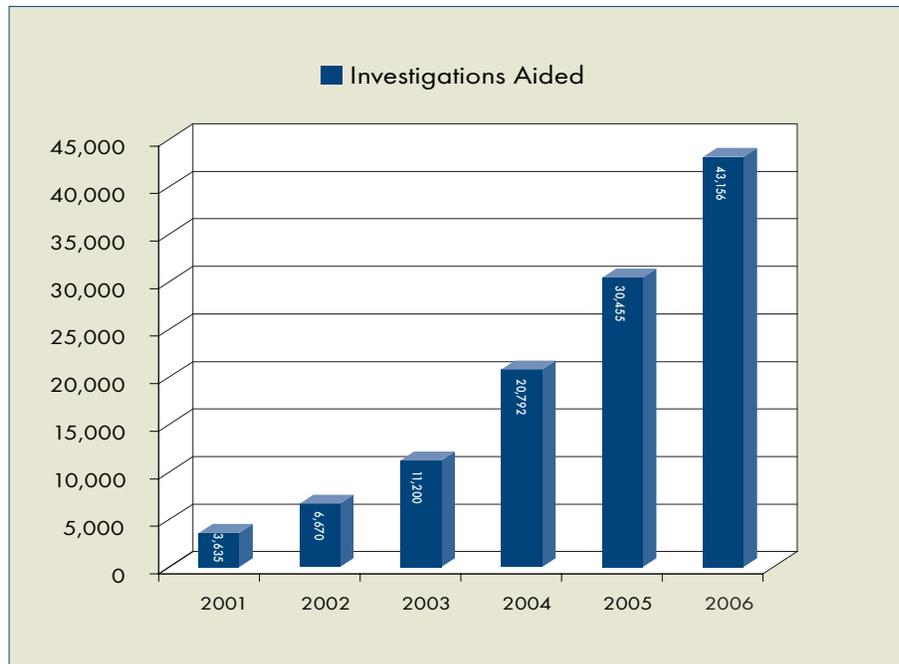
The charts below depict the statistics tallied by CODIS through the 2006 calendar year.

CODIS Statistics Through 2006	
Category	Total Number
Investigations Aided	43,156
Forensic Index Hits	9,529
Offender Index Hits	32,439 (28,163 at SDIS and 4,276 at NDIS)

NDIS Statistics Through 2006	
Category	Total Samples
Offender Index	3,977,433
Forensic Index	160,582

Participants	
Domestic Laboratories	178 state and local laboratories plus NDIS
International Laboratories	40 laboratories in 26 countries
Training	1,173 individuals in more than 220 laboratories have received CODIS training.

	2001	2002	2003	2004	2005	2006
Offender Profiles	750,929	1,247,163	1,493,536	2,038,514	2,826,505	3,977,433
Forensic Profiles	27,897	46,177	70,931	93,956	126,315	160,582
Investigations Aided	3,635	6,670	11,220	20,792	30,455	43,156
Forensic Hits	1,031	1,832	3,004	5,147	7,071	9,529
Offender Hits Total	2,371	5,032	8,269	13,855	21,519	32,439
----National	167	638	1,151	1,864	2,855	4,276
----State	2,204	4,394	7,118	11,991	18,664	28,163



## CODIS Facts

- CODIS began as a pilot project in 1990.
- The DNA Identification Act of 1994 formalized the FBI's authority to establish a national DNA index for law enforcement.
- NDIS became operational in October 1998.
- The CODIS database originally was used to collect only the DNA of convicted sex offenders.
- The primary purpose of CODIS is to help solve crimes in which there are no suspects.
- CODIS contains only information necessary for making matches; it does not contain any personal identifying information—including names, dates of birth, Social Security numbers, criminal history, or case-related information.
- A CODIS profile consists of a specimen identifier, an identifier for the laboratory responsible for the profile, a DNA personnel identifier associated with the analysis, and the actual DNA characteristics (DNA profile).

- Only noncoding regions of a person’s DNA are used to develop a profile because those regions give absolutely no genetic information about race, medical history, or predisposition to disease.
- A “hit” is a match that provides law enforcement with an investigative lead that would not otherwise have been developed.
- CODIS is designed so that forensic laboratories have control over their own data.
- State law governs which specific crimes are eligible for CODIS.
- All 50 states have passed DNA legislation authorizing the collection of a DNA profile from convicted offenders for submission to CODIS.
- Identical twins have the same DNA profile.
- DNA is present in white blood cells, not red blood cells, which lack nuclei.
- Saliva itself *does not* contain DNA, but cells that line the inner cheek and contain DNA are almost always found in saliva.

## **Cryptanalysis and Racketeering Records Unit**

A drug dealer codes the list of his best customers; a member of a terrorist cell hoping to strike in the United States sends an encrypted e-mail to his cohorts; a prison inmate sends a coded message to his brother on the outside, confessing to a crime. All of these possible scenarios involve the work of the Laboratory’s Cryptanalysis and Racketeering Records Unit (CRRU). The CRRU supports all FBI investigative programs by examining manually encrypted records and communications from a variety of sources. The case described below illustrates some of the unit’s work.

### **400-Year-Old Cipher Used to Send Murder Hit**

On August 26, 1997, an innocent-looking letter announcing the birth of a grandson was mailed from the Federal Bureau of Prisons Supermax facility in Florence, Colorado, to an address in California. However, the writer of the letter was not a new grandpa, and the letter was anything but innocent. The letter was written by a senior member of the Aryan Brotherhood (AB) prison gang, and secretly imbedded within the characters of the letter was an AB declaration of war against black inmates throughout the federal prison system. Shortly after the letter was sent, AB operatives in a federal prison in Lewisburg, Pennsylvania, executed a carefully coordinated, simultaneous attack on black inmates, killing two and severely wounding four.

Eight years after the Lewisburg murders, 40 members of the Aryan Brotherhood were caught up in a sweeping federal Racketeer Influenced and Corrupt Organizations (RICO) indictment in California. The 1997 letter containing the enciphered declaration of war was recognized as a key piece of evidence and submitted to the CRRU for analysis and decryption.

In May 2006 a cryptanalyst/forensic examiner from the CRRU explained the complex encipherment process to a federal jury in Southern California. The message was enciphered using a double encryption method developed by Sir Francis Bacon (1562–1626). The Baconian cipher was designed as a method of concealing a secret message within a larger body of text referred to as “covertex.” The first step of the

encipherment involved replacing each character of the secret message with a unique string of “A” and “B” values from the chart below. For example, to encipher the word “BACON,” each character is replaced with five A’s and B’s as follows:

“Plaintext”:     B       A       C       O       N  
 “Ciphertext”:   BABBB BBABB BBBAA AAABB ABAAA

In the second step, the string of A and B values is matched to each letter of the covertext and is used to determine the style of writing used for each letter. Covertext characters assigned an A value will appear in one style, and the covertext characters assigned a B value appear in a different style. In the submitted document, plaintext was recovered by assigning an A to covertext letters appearing as Roman type and assigning a B to the covertext letters appearing as italicized or cursive writing.

The ciphertext string of A and B values was then parsed into groups of five and deciphered as follows:

~~BUBBA~~ ~~8-77-97~~  
 B B B A A  
 JUST A LINE OR TO LET YOU KNOW  
 A A A B B A B A A A B A B A B B A B A A A B A  
 ALL IS WELL AND HOPEING YOU ARE THE  
 B A A A B A A A B B B A B A B A A A B B A A

BBBAA AAABB ABAAA BABAB BABAA ABABA AABAA  
 C O N F I R M

AABAA BABBA ABBAA ABBAA BBABB BAABB BABBA  
 M E S S A G E

The complete message was a confirmation of an order to coordinate the murder of black inmates from the District of Columbia:

CONFIRM MESSAGE FROM CHRIS TO MOVE ON DC

The CRRU decryption was a key piece of evidence linking the Aryan Brotherhood leadership in Colorado with the murders in Pennsylvania, and the jury found the four defendants guilty on multiple charges of murder, extortion, and racketeering.

Plaintext	Ciphertext	Plaintext	Ciphertext
A	BBABB	N	ABAAA
B	BABBB	O	AAABB
C	BBBAA	P	AABAB
D	BBABA	Q	ABAAB
E	BABBA	R	ABABA
F	BABAB	S	ABBAA
G	BAABB	T	AABBB
H	BBAAA	U	ABABB
I	BABAA	V	ABBAB
J	BAAAA	W	ABBBA
K	AAAAB	X	ABBBB
L	AAABA	Y	BBBBA
M	AABAA	Z	BBBAB

Baconian Cipher Key

## DNA Analysis Unit I

The DNA Analysis Unit I (DNAUI) performs serological and nuclear DNA analyses on biological evidence collected from crime scenes. Serological analysis involves examining evidence for the presence of biological materials such as blood and semen. Nuclear DNA analysis involves further characterizing biological material through DNA typing in an effort to determine if a particular individual is or is not the source of the DNA present within a biological material. Nuclear DNA analysis is also performed on evidentiary materials that may not require serological testing, such as cigarette butts, cans, bottles, and envelopes.

DNAUI also maintains the Federal Convicted Offender (FCO) Program. The FCO Program oversees the collection and processing of samples from any individual convicted of a federal felony. The DNA-typing results from these samples are entered and uploaded into the National DNA Index System (NDIS) for nationwide database searches. The FCO Program began in mid-2001. During the first four years of its existence, the FCO Program received approximately 100,000 samples. New legislation passed by Congress in November 2004 increased the number of samples received the following year by an additional 100,000, bringing the total to more than 200,000. The FCO Program is currently using robotics and automation to process the high volume of samples required by the new legislation.

DNAUI personnel often provide training on the science behind serology and nuclear DNA analysis as well as on the collection and preservation of evidence to be submitted for serological and nuclear DNA examinations. Other instruction given involves the quality assurance measures required for laboratories that perform DNA analysis. More than 2700 court officials and law enforcement and forensic laboratory personnel were trained by DNAUI personnel in 2006 through separate in-services, schools, seminars, and conferences.

Several DNAUI personnel are also involved in the administration of two of the scientific working groups: the Scientific Working Group on DNA Analysis Methods (SWGDM) and the Scientific Working Group on Bloodstain Pattern Analysis (SWGSTAIN). DNAUI personnel serve as chair, vice chair, or members of various committees of the two working groups, where technical information and potential improvements to the disciplines are discussed among experts in the related fields.

### Homicide, Assault, and Arson in the Virgin Islands

Renell Lettsom was charged with homicide, assault, and arson in St. Thomas, U.S. Virgin Islands. The victims in this case were a father, David Geiger, and his son, Nathan, who was 14. David died as a result of a brutal assault. Nathan survived his injuries; however, he now suffers from memory loss and seizures as a result of the incident. Nuclear DNA testing was performed on blood evidence recovered from the Geiger household, as well as from the mouth area of a water jug found at the scene. Nuclear DNA profiles developed from both sets of evidence samples matched the DNA profile from the suspect charged with the offense. In August 2006 the defendant was convicted of all charges and sentenced to life in prison without parole.



*A DNAUI biologist uses a phenolphthalein chemical test to examine a knife for the presence of blood.*



*A DNAUI biologist cuts a bloodstain from a shirt to be further characterized by nuclear DNA analysis.*

## DNA Analysis Unit II

The FBI Laboratory's DNA Analysis Unit II (DNAUII) examines a different type of DNA than the DNAUI. While the DNAUI examines nuclear DNA, the DNAUII examines mitochondrial DNA (mtDNA). Mitochondrial DNA is inherited only from the mother, and the cells may contain thousands of copies of mtDNA. For this reason, even old items of evidence and small pieces—such as hair, bones, and teeth—may be analyzed for their mtDNA content. Mitochondrial DNA analysis also makes it possible to identify missing persons through their maternal relatives.

Because mtDNA can link missing persons to their relatives, the DNAUII participates in the National Missing Person DNA Database. The unit also has program responsibility for the Regional Mitochondrial DNA Laboratory Program and the SWGDAM mtDNA Population Database.

### Serial Suspect Stopped

On the morning of March 25, 2004, Garland Hall broke into the apartment of a University of Michigan student. He attempted to rape her, but she fought him off. Before fleeing the victim's residence, Hall stole her laptop computer. Soon after the attack, police arrested Hall driving with his car lights off. He was in possession of the student's laptop, as well as the cell phone of a victim of a previous home invasion. After Hall's arrest, the police discovered that he was wanted on a warrant for window peeping. He was also the prime suspect in a series of home invasions and sexual assaults involving University of Michigan and Eastern Michigan University students.

A judge ruled that the search of the vehicle was illegal, making the laptop inadmissible as evidence. Hall pleaded guilty to lesser charges and served several months in jail.

Hours before the attack on the University of Michigan student, an Eastern Michigan University student had been attacked and sexually assaulted in her home. The suspect left near the crime scene a knit hat that the victim was later able to identify. A hair was found on the hat and analyzed by the DNAUII. The mtDNA sequence from the hat matched that of Garland Hall. After several trial delays, Hall finally went to trial in October 2006 on charges of first- and third-degree sexual assault and first-degree home invasion. An examiner from the DNAUII testified to the mtDNA results, and Hall was subsequently convicted on all charges. This suspected serial sexual assaulter will now serve many years in prison.

### Automated Analysis

The DNAUII validated two robotic platforms that automate the analysis of the entire control region of mtDNA. Two Biomek 2000 robotic workstations perform DNA extraction and preparation for polymerase chain reaction amplification. Amplification and mtDNA sequencing are accomplished using the TECAN Genesis Freedom robot. These robotic systems have greatly decreased the time required to perform mtDNA analysis on population database samples in the DNAUII. The robotic platforms are able to expeditiously process bloodstains and buccal swabs to enter into the SWGDAM mtDNA Population Database. In the future, automated analysis also will benefit the National Missing Person DNA Database by allowing the processing of samples from relatives of missing persons submitted for entry into the database.



*The DNAUII uses the Biomek 2000 robotic workstation to process samples.*

## **The National Missing Person DNA Database**

Established in 2000, the National Missing Person DNA Database (NMPDD) Program provides investigators with an opportunity to identify missing and unidentified persons on a national level. It contains three indexes in which DNA profiles can be entered: Biological Relatives of Missing Persons, Unidentified Human Remains, and Missing Persons. Both of the FBI Laboratory's DNA Analysis Units perform DNA analysis on samples for these indexes.

Since the program's inception, the DNAUII has completed 1058 missing-person cases submitted by local, state, and federal agencies. These have resulted in 130 mtDNA associations for samples from the Unidentified Human Remains and Biological Relatives of Missing Persons Indexes. In 2006, 340 cases were submitted to the NMPDD for analysis, and the DNAUII processed 370 cases for mtDNA analysis.

In addition to processing cases, members of the NMPDD have been active in educating the forensic and law enforcement communities about the value of this program to investigators of missing-person cases. Presentations detailing the purpose of the program and submission guidelines were provided to various agencies and organizations, including the National Association of Medical Examiners, International Homicide Investigators, and the FBI's Child Abduction Rapid Deployment Teams. NMPDD examiners also participated in a series of conferences sponsored by the National Institute of Justice concerning the identification of missing persons. The conferences targeted a diverse audience, ranging from law enforcement officers, forensic scientists, coroners, medical examiners, and family members of individuals who have been missing a long time.

## **Regional Mitochondrial DNA Laboratory Program**

To enhance the nation's capacity to perform mtDNA analysis in forensic and missing-person cases, the FBI Laboratory partners with four regional crime laboratories in Phoenix, Arizona; Meriden, Connecticut; St. Paul, Minnesota; and Hamilton, New Jersey. Prior to the regional laboratories' inception in 2003, the FBI Laboratory was the only crime laboratory in the United States providing no-cost mtDNA examinations to state and local law enforcement agencies.

Since the program began accepting casework in late 2005, more than 285 cases have been assigned to the four regional laboratories. The work provided by the regional laboratories has produced investigative leads for local law enforcement and aided in the identification of unidentified human remains. The first testimony by a regional laboratory analyst took place in New Hampshire in 2006, and several subpoenas have been received for testimony across the United States. Each of the four laboratories underwent external audits in 2006 to gain approval to upload mtDNA profiles into the National Missing Person DNA Database.

## **Firearms-Toolmarks Unit**

When a subject uses a weapon or a tool to commit a crime, personnel in the Firearms-Toolmarks Unit (FTU) examine the evidence. Evidence in a typical case may include weapons such as rifles, pistols, and shotguns; silencers and other muzzle attachments; magazines; holsters; and both fired and unfired cartridges. Firearms-related evidence—including lead and other metal fragments, shot wads, shot cups, and bullets—also may be removed from bodies at autopsy and submitted to the unit. Toolmark evidence includes everything from screwdrivers and crowbars to sheet metal, safety-deposit boxes, and pieces of human bone and cartilage.

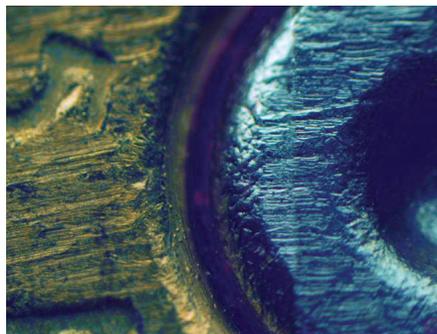


*FTU comparison microscope makes it possible to observe two specimens simultaneously. The monitor next to the microscope displays the image.*

Forensic firearms examinations involve determining whether a bullet, cartridge case, or other ammunition component was fired using a particular firearm. Bullets and ammunition components are microscopically compared with each other and with any number of firearms to determine whether an association exists between the items submitted as evidence and items whose origins are known. Forensic toolmark identifications involve determining whether a particular tool produced a particular mark. Micro- and macroscopic features of toolmarked items are compared with known and questioned tools that may have produced them.

FTU personnel also perform other examinations, including trigger-pull tests, function tests, full-auto conversion tests, shot-pattern examinations, gunshot residue examinations on victims' clothing, ejection-pattern testing, trajectory analysis examinations, silencer testing, and serial-number restorations.

To help achieve its mission, the FTU maintains two reference collections: the Reference Firearms Collection and the Reference Ammunition File. The unit's firearms collection contains more than 5600 handguns and shoulder firearms. The ammunition file includes more than 16,000 military and commercial ammunition specimens from both domestic and international manufacturers.

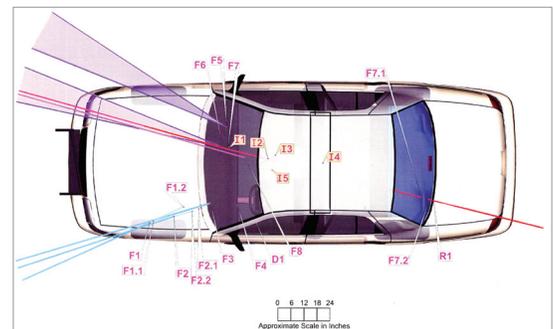


*FTU toolmarks: impression toolmarks present on the primer of a cartridge case, as seen when looking through a comparison microscope*



*FTU serial-number restoration: On steel firearm frames/receivers, the serial number is restored using a mixture of magnetic shavings and oil.*

In addition to examining evidence in the Laboratory, FTU examiners also assist field agents and other federal, state, local, and international law enforcement agencies. FTU personnel support FBI investigations and administrative inquiries, providing crime scene trajectory reconstruction and analyses. Training and liaison with national and international forensic laboratories and law enforcement agencies also represent important components of the FTU's mission.



*FTU bullet trajectory: bullet trajectory analysis of a shooting incident showing the location and the angles from which the automobile was shot*

## Latent Print Operations Unit

The Latent Print Operations Unit (LPOU) comprises six teams of forensic examiners, an Administrative Review Program, and a Case Flow Management Program. Forensic examiners conduct friction ridge examinations, produce written reports of their findings, present expert testimony in legal proceedings, and provide training and field support to national and international law enforcement personnel. The Administrative Review Program Manager reviews all reports issued by the LPOU. The Case Flow

Management Program Manager ensures efficient work flow by coordinating case assignments. The Case Flow Manager also handles questions from the field regarding evidence submissions.

### **Identifying a Serial Rapist**

Local law enforcement officers and FBI investigators formed a task force in Mobile, Alabama, to investigate the activities of a serial rapist. In February 2005 the Evidence Response Team (ERT) from the FBI's Mobile Field Office was called to process a crime scene for evidence. The ERT found a latent palm print on the wall over the victim's bed. In March 2005 the print was submitted to the LPOU for comparison.

Johnny Moffett had been arrested in previous assaults, but there had never been any physical evidence linking him to the crimes. Moffett's prints were submitted to the LPOU for comparison with the palm print from the victim's bedroom. The LPOU examiner identified the palm print from the crime scene with the submitted palm prints of Moffett and reported the identification the same week. In September 2006 the examiner testified in the trial. The palm print was the most important piece of physical evidence linking Moffett to the crime. He was given four life sentences for first-degree rape, sodomy, sexual abuse, and burglary.

### **Latent Print Support Unit**

The Latent Print Support Unit (LPSU) covers five program areas. The Integrated Automated Fingerprint Identification System (IAFIS) Program coordinates, tests, evaluates, and implements new IAFIS hardware and software from the latent print perspective and coordinates with the FBI's Criminal Justice Information Services (CJIS) Division and the criminal justice community on all latent-print-related IAFIS issues. The IAFIS Program is currently working with the CJIS Division on a number of joint issues, most notably, the design of the next generation of IAFIS, known as Next Generation Identification.

The Major Incident Management Program serves as the point of contact to deploy the Disaster Squad and other special operations teams. The Standards and Practices Program manages the quality assurance program for the LPOU and LPSU. This includes drafting, implementing, and maintaining the *Latent Print Quality Assurance Manual* and the *Latent Print Operations Manual*. The Technology Development Program operates the Latent Print Digital Imaging System and coordinates, tests, evaluates, and implements advances in biometric technology to improve friction ridge analysis.

The Training Program manages all aspects of training for both the LPOU and the LPSU. This comprehensive training program covers training for latent print physical scientists/forensic examiners; in-service training for both FBI employees and law enforcement personnel from outside agencies; continuing education training for latent print employees; latent print training for Indian Country Evidence Task Force and Evidence Response Team personnel; and training for new agents at the FBI and DEA academies.

The LPSU's five programs ensure the continued high quality of friction ridge examinations, as well as compliance with FBI, Laboratory Division, and accreditation board policies, procedures, and guidelines.

### **Disaster Squad Deployments: Iraq and Afghanistan**

The bodies of service members killed in combat are shipped to Dover Air Force Base Mortuary for identification and burial preparation. In 2006, 52 examiners from the LPOU and LPSU were deployed to

Dover for 216 days. Along with other members of the Disaster Squad, they examined the bodies or body parts of approximately 1000 soldiers killed in Iraq and Afghanistan, identifying 813 victims by their fingerprints. In addition to identifying soldiers, the Disaster Squad also identifies the bodies of civilians killed in the war.

## Photographic Operations and Imaging Services Unit



*POISU photographers documenting evidence in the FBI Laboratory's photographic studio*

The Photographic Operations and Imaging Services Unit (POISU) coordinates and manages photographic services for the FBI. These services include operational, investigative, and forensic photography; technical assistance; camera and darkroom equipment procurement and repair; and forensic imaging training. Although digital imaging techniques have become standard practice, POISU also uses traditional silver-based methods to capture, process, and produce photographic images.

Managing both the FBI Photographic Program and the Field Photographic Program involves overseeing more than 125 full-time and backup photographers in the FBI's 56 field offices. In addition, POISU provides investigative and forensic photography, imaging, and photographic-processing support for federal, state, local, and international law enforcement investigations.



*POISU photographers documenting evidence in the field*

POISU is divided into three separate subunits with very distinct and specific responsibilities.

**The Operations and Training Subunit** provides photographic support and services to the Laboratory, FBI Headquarters divisions, and all FBI field offices. Scientific and technical photographers in this subunit deploy to major crime scenes, agent-involved

shootings, and other operational or investigative events. The increase in terrorism-related investigations means that scientific and technical photographers must deploy to document scenes involving chemical, biological, radiological, nuclear, and explosive devices. This subunit also provides a large percentage of the photographic training conducted in the FBI. These classes include new agents, field photographers, and outside agencies and cover virtually every aspect of forensic imaging.



*FBI field photographer*

**The Photographic Equipment and Support Subunit** has many responsibilities. Personnel assigned to this subunit design and install photographic camera concealments; procure, disseminate, and repair photographic equipment, including digital darkrooms with video workstations; manage field-office equipment transitions and upgrades; and manage all photographic production for the FBI. This subunit annually

produces more than 1.5 million images in both hard copy (photographic prints in sizes ranging from 4 by 6 inches to 4 by 8 feet) and in digital form (CDs and DVDs). This subunit also oversees three regional photographic minilabs, in Atlanta, Chicago, and San Francisco.

**The Photographic Services Subunit** oversees the Portrait and Events Studio at FBI Headquarters, the Tactical Site Survey Program, the Aerial Photography Program, and the Technical Imaging Group. The Portrait and Events Studio photographs special events and official portraits for executive management and documents the anniversaries and retirements of FBI personnel. Personnel assigned to the Tactical Site Survey Program work directly with the FBI's Hostage Rescue Team, Special Weapons and Tactics Teams, and other government agencies, such as the National Geospatial-Intelligence Agency, to create virtual walk-throughs of special-event venues or high-risk locations. The Aerial Photography Program provides vertical images of infrastructure, crime scenes, special-event venues, and other areas for investigative and tactical planning. The eight photographers assigned to the Technical Imaging Group (TIG) use digital and conventional forensic photographic techniques to capture, process, and print high-quality images of latent fingerprints for the Laboratory's Latent Print Units. In addition to conducting criminal casework, TIG photographers also capture a high volume of latent impressions in support of the Terrorist Explosive Device Analytical Center.



POISU photographers recording tactical site survey images at Dolphin Stadium for Super Bowl XLI

## Questioned Documents Unit

The Questioned Documents Unit (QDU) serves the law enforcement community by providing forensic support to federal, state, and local law enforcement agencies. The QDU conducts a variety of examinations on crime scene evidence submitted to the Laboratory. These include analysis of handwriting, typewriting, shoe prints, tire treads, alterations, obliterations, rubber stamps, plastic bags, and shredded documents.

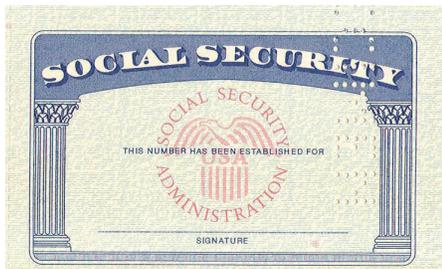
### Combating Identity Theft

The QDU was integral in the successful prosecution of a major theft ring that operated out of Cleveland, Ohio, and surrounding states. The case, *United States v. Richard Tisdale et al.*, involved an organized ring of shoplifters who used the stolen identities of children to conceal their true identities and launder nearly \$1 million in proceeds through federally insured financial institutions in Ohio. Tisdale and members of his group stole computer merchandise from stores throughout Ohio and surrounding states, then sold the merchandise to a Cleveland-based, Russian-born computer store owner, Gregory Khabner. Khabner repackaged the stolen merchandise and sold it at discounted prices to other Russian store

owners and the general public. Tisdale, whose extensive criminal history dates back more than 40 years, manufactured drivers' licenses, Social Security cards, and other identity documents for himself and members of his theft ring using the identities of children and, in one case, a kidney dialysis patient at the Cleveland Clinic.

The QDU examined a laminated Social Security card and 13 copies of Social Security cards that were found in a hotel room where Tisdale manufactured his fraudulent documents. Through microscopic examination of the laminated card and the 13 copies, the QDU determined that the cards originated from a color ink-jet office machine. The questioned Social Security card was compared side by side with genuine Social Security cards from the QDU standards file.

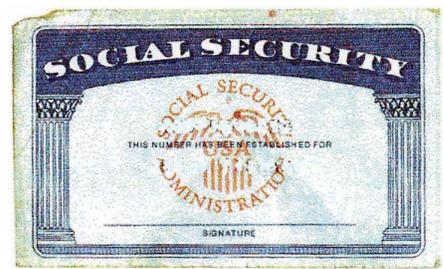
The QDU determined that the questioned card was a counterfeit. The 13 copies appeared to be at various stages of manipulation in an effort to counterfeit Social Security cards. On one copy, the Social Security number and cardholder's name were obliterated with correction fluid. Using special lighting techniques, the QDU was able to decipher the obliterated name and Social Security number, which were later revealed to be those of the suspect's brother, Jon Tisdale. The QDU compared this manipulated copy to the counterfeit card and was able to positively identify it as the model for the counterfeit.



Genuine Social Security card from the QDU standards file



Counterfeit Social Security card



Manipulated "model" for counterfeit Social Security card

A QDU examiner testified at Tisdale's trial in Akron, Ohio. This testimony was crucial in supporting the identity-theft charges.

Richard Tisdale was sentenced to 15 years' incarceration, to be followed by 3 years' supervised release. In addition to Tisdale's conviction, the investigation resulted in guilty pleas from Tisdale's brother, Jon Tisdale, and Gregory Khabner, both of whom are currently serving prison time for their roles in the scheme. The Government also obtained a conviction against Tisdale's girlfriend, Andrea Dent, who participated in the identity thefts and shoplifting and refused to cooperate during the investigation.

## SoleSearcher

SoleSearcher is an innovative investigative tool the QDU uses to help determine the brand name or manufacturer of footwear from questioned footwear impressions left behind at crime scenes. Hundreds of these database searches are requested annually by law enforcement agencies in cases that range from burglary to terrorism. The database contains more than 11,000 different shoe outsole designs from more than 370 different footwear manufacturers from around the world. New outsole images are added to the database daily. With so many different



The SoleSearcher database uses different design icons commonly found on the outsole of shoes.

manufacturers and a majority of shoes being manufactured overseas, keeping up with all of these shoes is a monumental task.

SoleSearcher was designed using different design icons commonly found on the outsole of shoes. These different design icons are placed on a blank shoe canvas to resemble the questioned footwear impressions. The image is then searched through the database using the specific criteria. If the database produces a shoe outsole that is consistent with the questioned impression, a printout of this shoe outsole is sent back to the contributor. If the contributor has or develops a suspect or a person of interest, the contributor can use this print during a search to obtain the shoes needed to conduct further footwear examinations.

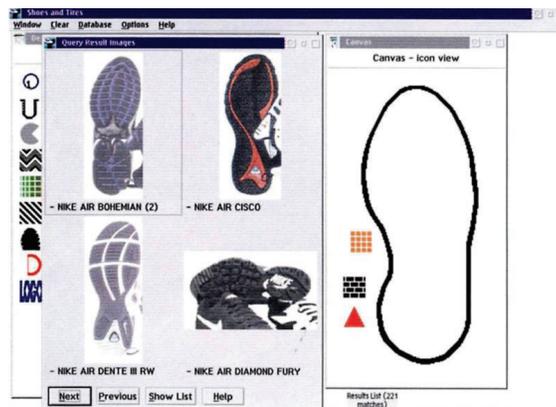
### ***SoleSearcher Success Story***

Over the years, SoleSearcher has provided valuable leads to investigators and law enforcement agencies around the country. One case in particular involved a double homicide that occurred in New Hampshire.

Two Dartmouth professors, Suzanne and Half Zantop, were found brutally murdered in their home in Hanover, New Hampshire. At the crime scene, investigators located a bloody footwear impression that did not match either of the victims' shoes. This bloody footwear impression was submitted to the FBI Laboratory in an attempt to determine the brand name or manufacturer. The impression was searched through the database, and a possible match was located. The footwear impression matched a VASQUE-style boot in the database. Descriptive information concerning the type of boot that left the bloody footwear impression was sent back to the investigators. Two teenagers were soon developed as suspects. When investigators asked one of the suspects, Robert Tulloch, if he owned a pair of VASQUE boots, he answered yes. Investigators collected the boots, compared them to the impression left behind at the crime scene, and determined that one of Tulloch's VASQUE boots had made the bloody impression. Tulloch pleaded guilty to life in prison without parole. The other suspect, James Parker, cooperated with police but still received a sentence of 25 years to life.



*Questioned footwear impression submitted to the Laboratory*



*Using specific design icons to search the database*



*The search result shows the sole of the brand of shoe that matches the questioned image.*

### ***The History of the Footwear Reference Collection***

The FBI Laboratory's first footwear reference collection dates back to around 1935. This collection consisted of a series of photographs of shoe soles and heels. These photographs were placed in file cabinets according to manufacturer. The reference-file searches were all conducted by hand. Back in the 1930s, this collection was considered complete because all shoes at that time were manufactured in the United States. The shoes were primarily dress shoes and perhaps a small number of casual shoes. Specialty athletic shoes were not introduced until the 1950s and 1960s.

The first computerized footwear database was introduced in the mid-1980s and was housed on a mainframe computer system. In the early 1990s, the footwear database was placed on a personal computer. The manufacturer would send in catalogs, and these outsole images would be scanned into the database. At that time, the database had approximately 2000 outsole images. Today, the database contains more than 11,000 images. In the future, the Laboratory plans to make SoleSearcher available through a secure network so other law enforcement agencies may electronically contribute and search footwear images in the database.

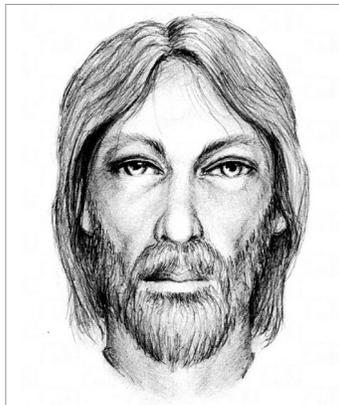
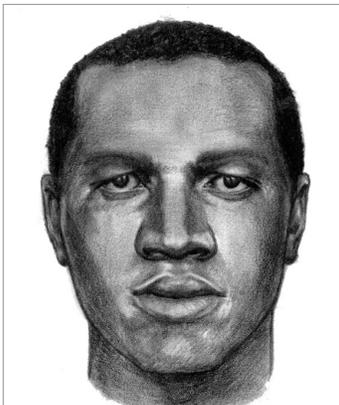
## **Special Projects Unit**

The Investigative and Prosecutive Graphic Unit (IPGU) and the Structural Design Unit (SDU) worked closely for years to produce a multitude of two-dimensional (2-D) and three-dimensional (3-D) operational and demonstrative materials. These items are used to provide direct investigative, operational, and prosecutorial support for FBI agents and U.S. attorneys. Additionally, when circumstances warrant, these services are also provided to state and local law enforcement. In 2006 the IPGU and the SDU were merged to form the Special Projects Unit (SPU) in order to more efficiently serve the criminal justice community.

### **Forensic Facial Imaging**

In 2006, SPU personnel handled numerous cases requiring the production of facial imagery. These included requests for the preparation of artist composite drawings, 2-D and 3-D facial reconstructions from skeletal remains, postmortem drawings, and digital photographic retouches and manipulations. This imagery was provided in direct support of FBI counterterrorism, counterintelligence, and criminal investigations and was used both domestically and internationally. In addition, support was provided for the Department of Defense and intelligence personnel on the ground in Afghanistan, Somalia, and Iraq.

The following images were prepared through witness interviews and used to locate individuals wanted by the FBI. These individuals were located as a direct result of these drawings.



To further enhance and expand its response capabilities in the facial-imaging arena, in 2006 the SPU entered into a working agreement with the University of Tennessee at Knoxville (UTK) on several research projects. When completed, these projects will help lay a new foundation for many areas of facial imaging. One of these projects involves the 3-D scanning of human skulls that also have available life photos of those same individuals from the Anthropological Research Facility at UTK. The data collected from these scans will be used to develop a highly accurate reference database that will be used by forensic anthropologists and artists. This process will more clearly delineate the influence the skull has on the life appearance of the deceased individual. Information gained through this research will also

be used in ongoing research to create a computer program that will produce lifelike images from skeletal remains in an automatic manner and with accurate and consistent results.

The images below depict SPU personnel collecting digital data of skeletal remains at the Anthropological Research Facility at UTK.

An associative research proposal will work to develop a national database of all facial reconstructions, which currently number more than 40,000 unidentified individuals. This database will provide the platform through which any examiner can search all of the forensic reconstruction imagery entered into the database.

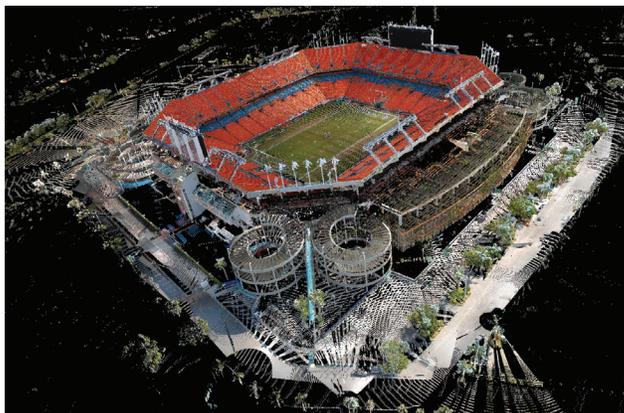


### **Situational Awareness and Special-Event Support**

SPU personnel provide a wide array of specialized support in the areas of situational awareness and special-event management. This support comes in the form of 3-D laser scanning and LIDAR (Light Detection and Ranging), 360-degree spherical video, panoramic photography, GIS (Geographic Information System) mapping, and interactive presentations. Most SPU efforts in this area go toward the documentation and digital reconstruction of the sites of major events or venues. The product prepared by SPU is used by command and tactical personnel for documenting venues to determine ingress and egress points, breaching points, sniper and counter-sniper locations, emergency evacuation plans, helicopter landing areas, desirable routes of travel, and other important information.

In 2006, SPU personnel responded to numerous requests for these types of services, such as operational/tactical packages for the NBA All-Star Game, the NFL Super Bowl, the MLB All-Star Game, the Kentucky Derby, the Little League World Series, and the Rose Bowl and Rose Parade, as well as the documentation of the football stadium and two basketball arenas at The Ohio State University.

The image below of Dolphin Stadium was “stitched” together using multiple scans to form a complete 3-D digital reconstruction of the stadium. This completed image is being used by operational and security personnel for event planning and security.



*The 3-D digital reconstruction of Dolphin Stadium*



*Close-up of the laser scanner used at the Miami Dolphins practice facility prior to the Super Bowl*

## **Crime Scene Survey, Documentation, and Reconstruction**

Throughout the year the SPU prepared numerous crime scene reconstructions in both 2-D and 3-D. Many of the requests for these services required unit personnel to travel to crime scenes and physically conduct site surveys and secure digital documentation data. These data enabled personnel to produce both physical and digital scale models and exhibits. To accomplish these duties, unit personnel use a wide array of equipment and methodologies, ranging from traditional manual equipment and methods to state-of-the-art digital and laser data-collection devices. Three-dimensional, high-resolution laser scanners were used to survey and document crime scenes that required high-end digital data collection. Often these types of scenes need to be accurately documented and reconstructed in order to show line of sight, bullet trajectories, evidence/debris disbursement, or the movement and relative location of individuals, vehicles, and other objects.

The SPU works closely with all of the operational entities within the FBI. However, its primary customers are the field Evidence Response Teams (ERTs) and the Evidence Response Team Unit (ERTU) in the Laboratory. Through this working relationship, SPU personnel provide support for all of the major crime scene investigations conducted by the FBI. Twenty FBI field office ERTs have personnel who are specially trained in the use of the Total Station survey equipment. A forensic engineer on staff in the SPU, along with personnel from the ERTU, oversees the operation of the field's Total Stations. As a result of this working relationship, in 2006 two to three submissions of Total Station data were received from each field team, totaling approximately 60 field-wide submissions. Each one of these was reviewed and processed for the participating field ERT survey team. In addition to the operational support provided by the SPU, unit personnel also provided training for the Total Station to ERT personnel.

## **Demonstrative Evidence**

The SPU's production of demonstrative evidence for courtroom presentation is as significant as its investigative and operational support efforts. This is exemplified by the support provided by the unit following the attacks of September 11, 2001. From the time the first airplane slammed into the World Trade Center until Zacarias Moussaoui was sentenced, SPU personnel produced hundreds of investigative and prosecutive items. These ranged from simple organizational charts, to the building of physical scale models of the Pentagon and the World Trade Center, to the creation of complex, digitally interactive displays that exhibit time-sensitive, multilayered interactions between individuals and events. These interactive presentations often included video and audio clips, scanned images of documents, digital telemetry from aircraft, and typed transcripts of telephone conversations. SPU's efforts in this area proved to be a major reason why the sentencing phase of Moussaoui's trial was successful.

Throughout the year SPU personnel routinely produced items of demonstrative evidence that proved pivotal to the successful outcome of many prosecutions. To accomplish this, unit personnel traveled to field locations, conducted interviews, met with investigators and prosecutors, and reviewed evidence and data. Through these efforts, they were able to create charts, maps, diagrams, models, and numerous types of trial aids and exhibits.

## **Training**

During 2006 the SPU provided both basic and advanced training for FBI, state, local, and international law enforcement personnel. This training included traditional courses held at the training academy in Quantico, Virginia, as well as seminars and workshops at various venues throughout the United States. These included Forensic Facial Imaging; Crime Scene Survey, Documentation, and Reconstruction; the Florida Division of the International Association for Identification Annual Educational Training

Conference; the 42nd Annual Forensic Dental Identification and Emerging Technologies Seminar; the Wisconsin Law Enforcement Executive Development Seminar; the Society of Manufacturing Engineers annual meeting; the Law Enforcement Executive Development Seminar; Total Station training for the Lebanese Police; training for FBI Field Photographers; Evidence Response Team Total Station training; and Evidence Response Team Bullet Trajectory training.

The SPU was also involved in the establishment and oversight of technology and programs directly related to its area of expertise. In this capacity, unit personnel were involved in or served on the following committees: the Imaging Technology Coordinating Committee, the International Association of Forensic and Security Metrology, and the International Association for Identification.

## Terrorist Explosive Device Analytical Center



Every day, sophisticated homemade bombs explode in Iraq, Afghanistan, and other places around the globe. These improvised explosive devices, or IEDs, sometimes claim hundreds of victims, both military and civilian. To stem the flow of attacks, the Terrorist Explosive Device Analytical Center (TEDAC) is working diligently to identify the terrorists and organizations that make and detonate these deadly devices.

Established at the FBI Laboratory in 2003, the TEDAC comprises personnel from law enforcement, intelligence, and military agencies. TEDAC experts examine thousands of pieces of evidence—often tiny fragments—to determine the form and function of the IEDs and, if possible, who built them.

The information developed at the TEDAC is compiled in a secure, accessible, central database and also serves as the basis for intelligence reports issued by the center. By functioning as a repository for both physical evidence and intelligence on IEDs, the TEDAC provides vital information to the intelligence community and especially to U.S. and allied military forces fighting in Iraq and other overseas operations.

The work of TEDAC personnel is sensitive and includes successes that may never be published in the news. However, the people who depend on TEDAC's efforts both in the United States and abroad can rest assured that TEDAC personnel are working hard to accomplish their mission of keeping U.S. interests and allies safe.

## Trace Evidence Unit

Physical contact between two people or between a person and an object often results in the transfer of trace materials. Identifying and comparing these materials may link a suspect to a victim or a crime scene.

The Trace Evidence Unit (TEU) identifies and compares these trace materials. Scientific examinations of physical evidence include the areas of hairs, fibers, fabric, cordage, soil, glass, building materials, feathers, wood, gemstones, and physical anthropology. Unit personnel also provide expert testimony relating to these examinations in legal proceedings, provide training to the law enforcement community,



*Samples of soil exhibiting distinct macroscopic differences in color and texture*

provide forensic field support in FBI cases, and develop and implement new technologies to enhance scientific examinations.

In support of the caseworking mission of the FBI Laboratory, in 2006 the TEU completed analysis on approximately 11,000 items of evidence in 2700 cases. These cases were received from city, county, state, federal, and international law enforcement agencies. Approximately 1700 cases were completed in support of the Terrorist Explosive Device Analytical Center, while approximately 200 cases were completed in support of the Indian Country Evidence Task Force. Each case may have involved several examinations and literally thousands of pieces of evidence.

To support the mission of training, the TEU sponsored or participated in numerous ventures. Members of the unit taught one- to two-week courses in hair and fiber analysis and Indian Country crime scene analysis to audiences in Quantico, Virginia; Asheville, North Carolina; Tucson, Arizona; and Marquette, Michigan.

To support the mission of FBI field offices, TEU personnel assisted in crime scene response in two body-recovery operations, lending assistance in the areas of forensic anthropology and mineralogy.

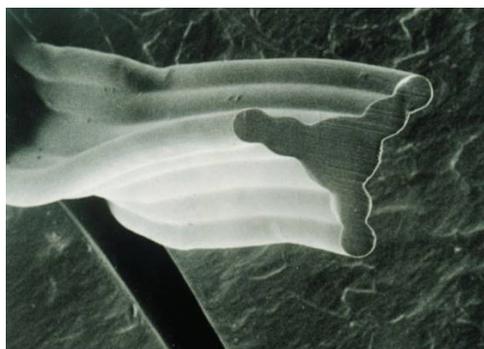
In support of the Regional Mitochondrial DNA Laboratory Program, the TEU trained one hair examiner who will work in one of the four regional laboratories. These laboratories partner with the FBI Laboratory to augment their capacity for mitochondrial DNA analysis in forensic and missing-person cases.

### **Pit Bull Predators**

Dorothy Sullivan, age 82, was fatally mauled by three pit bulls in her yard in Spotsylvania, Virginia. The dogs also killed Sullivan's shi tzu, Buttons. The TEU examined evidence recovered from the stomachs of the pit bulls and found hairs consistent with hairs recovered from the victim's hairbrush. The owner of the dogs, Deanna Large, was found guilty of involuntary manslaughter. This case marks the State's first successful prosecution of involuntary manslaughter in connection with a dog attack.



*The comparison microscope is routinely used for side-by-side comparison of hairs and fibers.*



*An electron micrograph of a cross section of a trilobal carpet fiber recovered from an automobile*



*The stereo binocular microscope is routinely used for the preliminary analysis of trace evidence.*



## Response Services

These units respond to incidents all over the world. They have specialized expertise and resources that allow them to work with hazardous materials and other dangerous substances. Working with other agencies, they can quickly and safely contain a scene and conduct their investigation while keeping others safe.

### Explosives Unit

The Explosives Unit (EU) has several broad areas of responsibility. The first area deals with the examination of evidence associated with bombing matters. The unit conducts forensic examinations of IEDs, incendiary devices, and their respective remains and provides expert witness testimony in court regarding the results of these examinations. These examinations involve the identification and intended function of the components used to construct the devices, including detonators, initiators, explosives, wires, tapes, containers, electronic components, timing mechanisms, and power sources.

The EU's mission includes direct field support in bombing matters and bombing crime scene investigations, as well as searches of bomb factories and safe houses in which bombs or bomb components may be encountered. The unit conducts liaison with domestic and foreign manufacturers of explosives and maintains the Explosives Reference File (ERF) and the Explosives Reference Tool (EXPeRT) database to support forensic examinations. In addition, the EU conducts training in bombing crime scene investigations and researches new methods of analysis to help ensure the continued leadership role the FBI Laboratory has come to play in terrorist bombing matters.

The EU also performs chemical analyses to determine the type of explosive used in an improvised explosive or incendiary device. This includes analyzing bulk substances and the residues left behind after an explosive detonates. Finally, the unit assists investigators in determining if debris from a fire of suspicious origin has an accelerant present.

In 2006 the EU provided forensic and/or technical assistance for several international bombing crime scenes/searches. The unit also provided training to more than 200 federal, state, and local investigators on bombing crime scene investigations. In addition, the EU provided financial support and subject-matter experts in support of the FBI's Large Vehicle Bomb Post-Blast Course. The only one of its kind, the course provides critical training for U.S. military personnel; federal, state, and local investigators; and numerous international law enforcement partners.

In September 2004 the FBI's Memphis Field Office received information from the Tennessee Bureau of Investigation that Demetrius Van Crocker was attempting to obtain materials to construct a bomb, which he intended to detonate in a federal or state courthouse. Crocker, a Tennessee farmhand with an IQ of 85, met with a cooperating witness, who recorded several conversations confirming Crocker's intent. The initial investigation exposed Crocker's right-wing beliefs, which are closely aligned to such groups as the Ku Klux Klan and other white supremacist/neo-Nazi organizations. While discussing his plans

to bomb a courthouse, Crocker said, “The country needs to be taken back by the people.” Crocker also expressed his deep hatred of the U.S. government.

On October 25, 2004, special agents from the Memphis Field Office arrested Crocker in Jackson, Tennessee, after he met with an FBI undercover agent. During the meeting, the undercover agent provided Crocker with an inert canister of sarin gas and a block of inert C-4 plastic explosive, represented as being stolen from a military installation in Louisiana. A small quantity of live explosive was actually placed in the inert C-4 block at the request of the prosecutor. Later that same day, agents executed a search warrant at Crocker’s residence in McKenzie, Tennessee, and discovered items believed to be intended to construct an IED. These items consisted of a 12-inch metal pipe, an end cap, an inert hand-grenade body, hobby fuse, and two pounds of low-explosive powder. All of the items were submitted to the Laboratory for analysis to determine the chemical composition and whether they could be assembled into an IED.

The chemical analyses performed on the low-explosive powders identified them as black powder and Pyrodex. Together with the other items seized from Crocker’s residence, these explosives could have been used as the main charge of an IED.

On April 12, 2006, two Explosives Unit examiners traveled to Jackson, Tennessee, and provided testimony in U.S. district court about the conclusion of the evidence analyzed. Demetrius Van Crocker was convicted on April 16, 2006, and subsequently sentenced to 30 years in prison.

## **Evidence Response Team Unit**

The Evidence Response Team Unit (ERTU) has supported the operations of field office Evidence Response Teams (ERTs) since the unit’s inception in 1992. The ERTU provides training, crime scene equipment and supplies, and on-scene support to the ERTs in all 56 FBI field offices. These teams have grown in size over the years and currently consist of 1160 primary team members. The ERT program facilitated more than 2000 ERT responses during 2006.



*ERTU personnel assisting the Detroit Field Office in a search for evidence*

The ERTU services all field offices by providing:

- An annual budget for crime scene supplies and equipment.
- Mobile command posts and other specialty crime scene vehicles and trailers to use at crime scenes.
- Sophisticated tools, including forensic light sources, laser transit systems, digital cameras, and laptop computer technology.

The ERTU provides other critical services, to include:

- Numerous basic and advanced forensic training courses for all field ERT personnel.
- Operational ERT support and consultation to field offices upon request.

The ERTU also provides support to outside agencies. This has included training and consultation regarding the establishment of protocols associated with processing crime scenes and Sensitive Site Exploitation operations.

### ERTU Specialized Response Capabilities



*Underwater Search and Evidence Response Team personnel participating in a search for evidence in Iraq in support of an investigation conducted by the FBI's Louisville Field Office*



*Human Scent Evidence Team canine conducting a match-to-sample check during a child abduction/murder investigation*

### Human Scent Evidence Team

Created in 1999, the Human Scent Evidence Team uses specially trained human-scent evidence canine teams and scent collected from evidence to provide investigators with the ability to accurately trace the path of offenders away from the crime scene, to identify conspirators, to eliminate uninvolved suspects, and to minimize unnecessary investigative efforts, thus reducing the time and work hours needed to bring an investigation to a successful conclusion.

In the United States, at least five federal agencies and the military train and use detector canines to find bombs, accelerants, drugs, and food. However, the FBI is the only federal agency that collects human-scent evidence and uses human-scent evidence canines as an investigative tool. Although this program is relatively new to the FBI, many European nations have organized human-scent canine programs, in which the collection and use of human-scent evidence is defined by governmental regulations. Police departments in the United States routinely use tracking dogs

**Underwater Search and Evidence Response Teams (USERT):** In 2006 ERTU's USERT Program supported approximately 30 underwater evidence operations involving FBI and state and local investigations. These included a coordinated ERT USERT operation in the "Red Zone" in Iraq to search for evidence in a major criminal investigation.

**Forensic Canine Teams:** Human Scent Evidence Team and human-remains detection canines are provided to field ERTs across a broad spectrum of FBI investigations, including buried-body searches, child abductions, and domestic terrorism cases. In 2006 the ERTU actively initiated an in-house canine capability by procuring the first of two bloodhounds and adding two Forensic Canine Operations Specialists (humans) to its staff. The addition of a human-scent collection and identification capability illustrates the emerging technologies and cutting-edge techniques sought by the ERTU to enhance FBI forensic capabilities.

In 2006 the ERTU coordinated the joint deployment of USERT and forensic canine resources to Tennessee in a search for a missing child. ERTU personnel also provided on-scene support during search operations.



*ERT personnel participating in a search for evidence in a missing-child case in Tennessee*

to chase fleeing suspects, but the collection of human scent evidence for use throughout an investigation is a new concept for U.S. law enforcement.

### ***Canine Collar***

During the evening of September 30, 2005, in a home in Floyd County, Iowa, an argument occurred during a methamphetamine drug transaction between Jesse Patchin and James Dean Raymond. Following the argument, Patchin left the residence on foot. Approximately 40 minutes later, Raymond picked up a knife and drove away with Charles Gallmeyer.

On the morning of October 1, 2005, Patchin's girlfriend noticed blood in her car. Patchin was never seen alive again.

On November 5, 2005, the Evidence Response Team Unit's Human Scent Evidence Team used a scent pad collected from Jesse Patchin's clothing and recorded a positive scent match at the location of the drug transaction. The subsequent trail traveled from this location into a corn field along a country road. Positive responses were also recorded in the corn field using pads collected from Raymond's clothing.

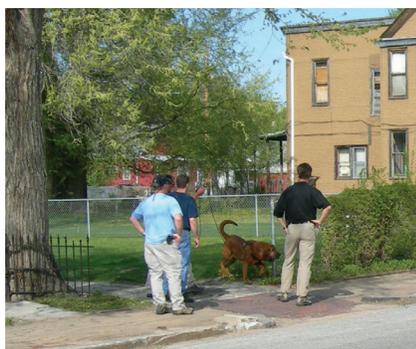
In January 2006 the State of Iowa reached a cooperation agreement with Gallmeyer that included Gallmeyer's disclosing the location of Patchin's body. Gallmeyer said that on the night of the homicide, as he and Raymond were driving back to the city, they saw Patchin walking along a gravel road. Gallmeyer led investigators to the exact location where the ERTU's Human Scent Dog Team had previously followed the scent from the residence and then to Patchin's body. According to a witness, Raymond admitted that after he and Gallmeyer had caught up with Patchin on the gravel road, Raymond had gotten out of the car and slit Patchin's throat. They later moved Patchin's body.



*Tinkerbelle conducts a search during a child abduction/rape case in St. Clairsville, Ohio.*



*Lucy searches for a top-ten fugitive in Chillicothe, Ohio.*



*Lucy conducts a geographic search of the neighborhood where a child was abducted.*

## **Canine Colleagues**

*Some FBI employees start young. Lucy, Mia, and Tinkerbelle were only 12 weeks old when they came to work for the FBI Laboratory. Who are these eager employees? Members of the FBI's Human Scent Evidence Team.*

*The basic training process for a human-scent evidence canine takes approximately one year and begins when the dog is only about 12 weeks old. Starting from this early age, the dogs are taught a short game of chase. It begins simply enough: the trainers run away from the puppies and allow the dogs to catch them. As the dogs grow, the distance of the chase extends. The trainers begin hiding at various points along the chase route to teach the dogs to use their nose and not their eyes. This phase of training culminates with a blind certification test on a 24-hour-old trail where the dog-handler team must accurately follow the trail and identify the person who laid it.*

*The FBI's advanced training program takes place when the dogs are between one and two years old. In this period, the canines are taught to smell odors collected from objects and accurately indicate to their handlers the presence or absence of a matching odor on the ground. This technique permits the FBI Human Scent Evidence Team to compare odors collected from a crime scene to suspects and indicate a match or nonmatch.*

*Since its inception, the Human Scent Evidence Team has conducted 1258 scent checks on 44 deployments in 30 cases, including 15 violent crime investigations, 12 terrorism cases, and 1 foreign counterintelligence investigation. With natural instincts and dogged determination, the FBI Laboratory's youngest employees sniff out evidence wherever it may lie.*

According to investigators, the findings made by the Human Scent Dog Team played a key role in evaluating and corroborating the information Gallmeyer provided about the murder.

## Hazardous Materials Response Unit

Responding to threats and incidents involving hazardous chemical, biological, radiological, and nuclear materials, including weapons of mass destruction (WMD), requires specialized expertise. The Laboratory's Hazardous Materials Response Unit (HMRU) has the knowledge and experience needed to handle these delicate investigations.

In addition to providing threat assessments to FBI field offices, legal attachés, and Headquarters divisions, the HMRU provides on-site support to all FBI investigations involving hazardous materials. In addition, the HMRU oversees on-site safety at high-hazard crime scenes, such as collapsed structures and confined spaces, and supports response operations that may involve hazardous materials.

The HMRU provides training, certification, and oversight for the 27 Hazardous Materials Response Teams (HMRTs) operating in FBI field offices. The more than 350 response personnel currently assigned to the HMRTs require response equipment, medical monitoring, and specialized training.

The main goal of HMRU/HMRT training is to produce members who are competent to enter hazardous materials crime scenes, in compliance with federal regulations. All HMRU/HMRT employees are required to complete the HMRU Hazardous Materials Operations Course and WMD Crime Scene Course, which teach the students how to respond safely and effectively to a hazardous materials crime scene. Other training—including Basic Microbiology and Biological Threats, Chemistry of Hazardous Materials, and Radiological Crime Scene Investigation Training—is offered to HMRT members based on the requirements of their position. In 2006 the HMRU trained approximately 466 HMRT members. In addition, the HMRU trained approximately 3000 local, state, and federal officials during conferences and exercises. Approximately 700 international students received training from the HMRU in cooperation with the International Training and Assistance Unit of the FBI's Training Division, the FBI's Counterterrorism Division, and the Department of Defense's International Counterproliferation Program.



*A student field-screens a chemical during Hazmat Operations class.*



*HMRU/Kansas City HMRT demonstration at Union Station, Kansas City, Missouri*

At the September 2006 International Symposium on Agroterrorism in Kansas City, Missouri, participants received training on the incident command system and the science behind field-screening hazardous materials. The training also covered the unit's Hazardous Materials Response Base of Operations Vehicle.

In 2006 the HMRU deployed on 57 missions, completed 190 scientific assessments, and provided operational advice via 219 conference calls. Success for the HMRU program is linked to close and effective working relationships within the FBI, with other government agencies, and in academia. Some notable HMRU deployments for 2006 include the following cases.

In January 2006, members of the HMRU provided presentations on WMD awareness at a meeting of the FBI's Richmond Field Office Joint Terrorism Task Force (JTTF). Following the meeting, the Richmond WMD Coordinator was approached by an officer of a local police department who had recognized that a photograph of castor seeds (the source of the toxin ricin) was similar to seeds the department had observed during a local crime scene search. As a result, the JTTF opened a WMD investigation, and the HMRU and HMRT members from the Norfolk Field Office searched for materials associated with the production of ricin.



Generic castor seed



An HMRU Base of Operations Vehicle and Rochester Fire Department HAZMAT units at the Rochester, New York, HAZMAT scene



HMRU chemists and HAZMAT officers, along with Rochester fire officials, analyze video images from the Rochester Fire Department's HAZMAT Team inside the HMRU Base of Operations Vehicle.

The HMRU responded to an anthrax incident in the New York area in February 2006. This incident received a significant amount of media coverage because of the unknown nature of how the individual became exposed to *Bacillus anthracis*, the causative agent of anthrax. The victim made drums from animal pelts, and the pelts potentially were contaminated with environmental *B. anthracis* spores. The HMRU conducted an environmental sampling mission in support of public health and the Centers for Disease Control and Prevention in several areas that were potentially contaminated with spores.

In July 2006 the Rochester Resident Agency of the FBI's Buffalo Field Office requested the assistance of the HMRU to help the Rochester Police Department and the Department of Environmental Conservation investigate a case involving an individual who had recently been evicted from his apartment. Upon entering the individual's residence, the eviction server noticed a large quantity of dangerous chemicals, including picric acid and mercury. Subsequent investigation determined no terrorism nexus; however, the HMRU and HMRTs were requested to provide scientific, technical, safety, and HAZMAT expertise to the Rochester Fire Department, the Rochester Police Department, and the Department of Environmental Conservation to assist them in successfully and safely resolving the incident.



## Research and Development Services

Research and development form the foundation of the FBI Laboratory's investigative services. The scientific breakthroughs developed in the Laboratory not only help the FBI solve cases but also advance the forensic sciences. Working with scientists from other government agencies and academia enhances the expertise of others while simultaneously benefiting the Laboratory. The Laboratory's work with international agencies leads to the development of global solutions to the crime problems facing the world today. The Counterterrorism and Forensic Science Research Unit leads the Laboratory's efforts in these areas.

### Counterterrorism and Forensic Science Research Unit

The Counterterrorism and Forensic Science Research Unit (CFSRU) researches, develops, and delivers new technologies and methodologies to advance forensic science and combat terrorism. To achieve this mission, CFSRU scientists work with scientists at other government agencies, including the U.S. Department of Homeland Security, the CIA, and the Centers for Disease Control and Prevention. Examples of recent research accomplishments include a comprehensive study on the use of specialized techniques for disarming improvised explosive devices; the development of software to decipher manually encrypted ciphers and interpret codes; the creation of technically engineered designs and prototypes of packaging to contain and transport radiologically contaminated evidence; and the production of portable containment devices to permit safe, effective forensic examination of contaminated evidence.

In 2006, unit personnel, together with participants in the Visiting Scientist Program managed within CFSRU, executed more than 100 research and development projects, presented findings at numerous national and international technical conferences, and submitted six manuscripts for publication in peer-reviewed scientific journals.

CFSRU scientists are leading experts in their respective fields and provide valuable advice and guidance to both the FBI and other law enforcement agencies as requested. In addition to its role in research and development, CFSRU provides advanced scientific training through specialized forensic classes offered to state and local law enforcement personnel. In 2006, CFSRU personnel conducted specialized classes with both interactive classroom lectures and hands-on laboratory exercises in such subjects as infrared spectrometry, forensic mitochondrial DNA analysis, and chromatographic methods.

As part of the CFSRU's outreach effort to assist state and local crime laboratories, unit personnel provided updates



*The Automotive Carpet Fiber Database provides the capability to use fiber evidence to identify the possible make, model, and year of automotive vehicles. Knowing the source of such fibers can enhance investigation and prosecution, especially in homicide and abduction cases.*

on active research at the 34th Annual Crime Laboratory Development Symposium held in Atlanta. The update featured six technical presentations by CFSRU personnel: the Permanence of Friction Ridge Skin Detail; Immunoassays for Body-Fluid Identification; Detection of Cocaine-N-Oxide and Other Cocaine Metabolites in Hair by Liquid Chromatography-Mass Spectrometry; Creation of an Automotive Carpet Fiber Database; Development and Validation of an Automated Biometric Handwriting Comparison System for Forensic Document Examinations; and Use of Three-Dimensional Imaging for Quantitative Comparison of Toolmarks. In addition, 26 technical scientific posters were presented on subjects related to anthropology, chemical analysis, counterterrorism, nuclear and mitochondrial DNA, document analysis, explosives, fingerprint examination, microbiology, photography, serology, toxicology, and trace evidence.

### **Cooperative International Teamwork**

CFSRU participated in the Forensic Review Panel coordinated by the European Network of Forensic Science Institutes (ENFSI). Subject-matter experts reviewed a protocol developed by the Russian precious-metal industry and the Russian Forensic Science Federation for determining the source of materials used in the processing of platinum-group metals. The goal of the panel was to come to a decision concerning the acceptability of this protocol in European courts, establish documentation concerning its forensic validity, and make suggestions for possible improvement. Sourcing of these materials is important because stolen platinum-group metals have been used to finance organized criminal enterprises, including those supporting international terrorism.

### **Cryptanalysis Support System**

CFSRU assisted in the development of the Cryptanalysis Support System (CRYSS), a machine-driven, cutting-edge tool that assists cryptographers in deciphering manually encrypted ciphers written in various languages and symbols. The program was installed for casework use in 2004, and since that time, it has been used to assist in deciphering more than 80 messages. In recognition of the significance of the program, Laboratory employees in CFSRU, the Cryptanalysis and Racketeering Records Unit (CRRU), and the IT Coordination Group who worked on the project received a Director's Award for Outstanding Scientific Achievement. CFSRU continues to support the CRRU with recent enhancements to the software aimed at applying the knowledge learned in developing CRYSS to the interpretation of codes.

### **Reality Enhancement/Facial Approximation by Computational Estimation**

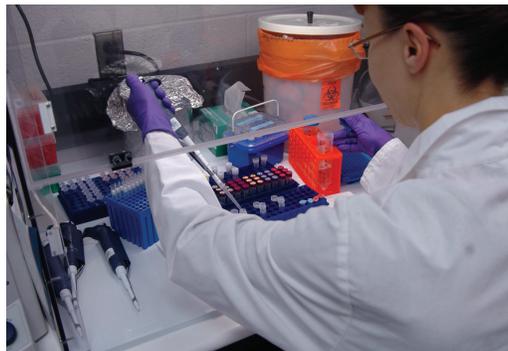
An automated, three-dimensional facial-reconstruction system has been developed under external contract, and the beta version is now undergoing validation. Reality Enhancement/Facial Approximation by Computational Estimation (RE/FACE) is a cutting-edge software program that provides facial approximation of human remains. This software has the potential to revolutionize the identification of unknown skeletal and decomposed remains of missing persons and victims of crime, mass disasters, and war, thereby providing assistance to all national and international investigative and law enforcement agencies.

### **Messenger RNA Profiling of Human Body Fluids**

Conventional methods of body-fluid identification use a variety of labor-intensive, technologically diverse serological techniques. Fully differentiated cells, such as blood lymphocytes or epithelial cells lining the oral cavity, have a unique pattern of gene expression, which is characterized by the relative presence and abundance of specific messenger RNA (mRNA) species. Using an RNA-based assay to identify biological stains offers several advantages over conventional methods, including greater

specificity, simultaneous analysis through common assay format, the potential for automation, and decreased sample consumption.

CFSRU is actively working to develop and validate a set of mRNA assays that can be used to identify human saliva, blood, semen, vaginal secretions, and menstrual blood. As proof of concept, CFSRU managed an external contract to develop a 15-plex reverse transcription-polymerase chain reaction (RT-PCR) assay, which is being optimized for use by the DNA Analysis Unit I. Through the Visiting Scientist Program, post-doctoral-level scientists are performing research to facilitate transition of the multiplex RT-PCR to routine casework. A method is being developed to coextract DNA and RNA from forensic samples that will allow practitioners to determine the source of a stain both in terms of genetic identity and body-fluid composition from a single sample.



*CFSRU performs research into methods, instrumentation, and protocols to support DNA analysis.*

### **Trace Volatile Organic Compound Analysis**

Detection of trace volatile organic compounds (VOCs) by canines for human odor/scent, human remains, narcotics, and explosives determinations is an important component of investigative law enforcement and forensic analysis. The use of canines for explosives or narcotics detection has a proven success rate; however, in these instances, the canines are trained on only a few compounds. Canines have been trained specifically to remember human odor on living persons and have been successful in matching suspects to proffered odor evidence. In this case, it has been determined that an ensemble of existing compounds could be responsible in a match-to-sample scenario. Criminal cases involving missing persons have been resolved by the ability of trained canines to store a victim's unique chemical signature and track this specific ensemble to crime scene locations or buried remains.

For human-scent detection, it would be beneficial for law enforcement to reproduce, via analytical instrumentation and methods, the capability of the canine to extract and detect trace-level VOCs from the air in nearly real time. This requires determining the target compounds and their respective concentrations. A method using analytical instrumentation has been developed and evaluated for the rapid detection and identification of trace-level VOCs. The new adaptive sampler can determine trace VOCs while working in the same air-flow regime as the canine. Optimization experiments are underway to further improve potential field use of the device.

### **Microbial Rosetta Stone**

CFSRU managed the development of a comprehensive database for microbial forensics that will provide law enforcement personnel with the ability to quickly obtain relevant information on a wide variety of biological threat agents and to store analytical data in an easily retrievable format. The Microbial Rosetta Stone (MRS) database system offers a repository of information on threat agents and will soon be deployed to multiple users. The system will provide the FBI with a resource that helps define the landscape of microbial threat agents and supports diagnostic assay development and characterization. The database gives law enforcement personnel a repository of information on biological agents that can be queried for risk-assessment analysis of threat incidents and assist with response planning.

An extensive amount of data on human, agriculture, and livestock pathogens and biological toxins that may be used as threat agents has been added to the system. A mass spectrometry literature collection

describing analytical methods for detecting bacteriological samples has been compiled and incorporated into the system. The MRS will enable documenting and tracking biochemical and genomic signatures for pathogens and provide users with a place to store, identify, query, and compare those signatures. The potential usefulness of the MRS system is evident by interest shown by other government agencies, including the Department of Homeland Security, the Food and Drug Administration, and the U.S. Department of Agriculture.

### **Visiting Scientist Program**

The Visiting Scientist Program provides a direct connection between the FBI Laboratory and academia. Visiting Scientists—who include university students, postgraduates, and faculty from institutions outside the FBI—work with CFSRU staff to enhance the FBI Laboratory’s research and development capabilities, meet the mission and needs of the Laboratory, and enhance their own education by participating in forensic research initiatives in the CFSRU laboratories using state-of-the-art equipment. In this way, Visiting Scientists not only increase their research contribution within their chosen field of study but also participate in a unique professional development opportunity.



*A Visiting Scientist performs research to extend the time window for detecting drug use from the analysis of hair samples.*

With an experienced CFSRU scientist to guide and mentor them, Visiting Scientists work on one or two projects designed to meet the needs of the Laboratory’s operational units. After a program lasting from three months to three years, participants submit detailed reports and technical papers for publication in peer-reviewed scientific journals. In 2006 program funding allowed the FBI to offer this opportunity to 45 Visiting Scientists representing 30 academic institutions. These scientists included 2 university faculty members, 15 postdoctoral fellows, 3 doctoral students, 6 master’s recipients, 8 master’s students, 5 bachelor’s recipients, and 6 undergraduate students.

Through a cooperative effort with the Department of Defense, the Visiting Scientist Program was expanded in 2006 to include military graduate students from the Uniformed Services University of the Health Sciences (USUHS). Six USUHS students participated in CFSRU research designed to meet the needs of the Laboratory’s operational units while simultaneously providing opportunities for scientific research suitable for incorporation into the students’ dissertations. This cooperative effort advances FBI research needs while helping to ensure a cadre of professionally trained and educated military scientists.

The Visiting Scientist Program was the focal point of an award established in 2006 to honor the commitment of Dr. Dwight E. Adams, former Director of the FBI Laboratory, to forensic science research and, in particular, to the training and development of future forensic scientists. The Dwight E. Adams Award recognizes a participant in the Visiting Scientist Program for exceptional scientific achievement and performance of research and development that address one or more priorities defined by the Director of the FBI. This award was presented for the first time in 2006 to Dr. Billy W. Acon, in recognition for outstanding performance during his tenure as a Visiting Scientist. Dr. Acon received a certificate and monetary award, and his name was engraved on a plaque currently on display in the Laboratory.

Additional information on the Visiting Scientist Program is located at <http://www.fbijobs.gov/242.asp>.



## Administrative and Support Services

These units play a vital role in supporting the mission of the FBI Laboratory. They ensure that the Laboratory has sufficient resources to operate, facilitate the efficient flow of evidence through the Laboratory, keep Laboratory employees safe and healthy, and maintain security on the premises, among other essential functions.

### Administrative Unit

The Administrative Unit (AU) supports the mission of the FBI Laboratory by coordinating, directing, and facilitating various programs and initiatives in the areas of administration, personnel, hiring, and mail services.

The AU's administrative responsibilities include the following areas:

- Awards.
- Ethics.
- Equal Employment Opportunity, Employee Assistance, and Upward Mobility Programs.
- Fleet management.
- Forensic examiner training, certification, and service agreements.
- Honors interns.
- Inspections.
- Manual revisions.
- Student loan repayment.

The AU's personnel and hiring responsibilities include:

- Promotions, transfers, and reassignments.
- Internal and external hiring initiatives.
- Staffing and funded staffing levels.
- Organizational charts and reorganization matters.
- Career-board coordination for special agent and professional support personnel.
- Promotional criteria and performance-based action oversight.
- Changes to and/or creation of position descriptions.
- Work-life matters, to include leave restoration, work-at-home options, alternate work schedules, and part-time employment.
- Availability-pay certification.
- Executive management requests.
- Resource Management and Allocation Committee coordination and facilitation.

The AU's Mail Services group provides in-house, full-service mail and shipping services for the entire Laboratory, to including mail metering; loading-dock functions; confidential-trash disposal; and incoming and outgoing shipments via the U.S. Postal Service, FedEx, and other courier services. The AU's areas of responsibility are highlighted in the following 2006 endeavors.

In February 2006 the FBI's Security Division requested changes to the organizational structure and reporting requirements of the Laboratory's security positions. As a result, in May 2006, security personnel were reassigned to the Laboratory's Operational Support Branch, and the Administrative and Security Unit became the Administrative Unit. This change in staffing has allowed the AU to devote additional time and effort to the Division's ongoing and constantly evolving human resource requirements, various policy compliance issues, and coordination of various programs under the unit's purview.

In 2006 the AU also helped the Human Resources Division redesign the FBI's recruiting Web site (<http://www.fbijobs.gov>). The goal of the project was to make the site more user-friendly, intuitive, and informative, as well as more attractive to candidates, thus increasing the number of quality individuals hired. Toward that end, the AU reviewed and updated a collection of documents describing the Laboratory's scientific positions. This project also involved reviewing, editing, and revising approximately 23 unit descriptions for a Laboratory Web page (<http://www.fbijobs.gov/311143.asp>) that links to the FBI's main job Web site. The Laboratory's page provides a synopsis of unit functions and positions, as well as their requirements, and represents an excellent tool to generate a greater interest in career opportunities in the Laboratory.

The FBI Laboratory must maintain a cadre of experienced and certified forensic examiners. Because of the amount of time and expense involved in training and certifying forensic examiners, the AU received oversight responsibility for the new examiner training and qualification process. The AU implemented a new Forensic Examiner Training Agreement Program (FETAP), which included establishing the program's policies, procedures, and guidelines. The FETAP provides a flexible framework and training for experienced, court-qualified forensic examiners. As such, each Laboratory unit with forensic examiners requires an individualized training plan to document as trainees earn the status of fully qualified, FBI-certified forensic examiners. This training plan includes evaluations and assessments of each trainee's previous training, experience, and expertise; identification of areas needing improvement and the design of individually tailored training plans to address these areas; oral boards; moot courts; and certification.

## Evidence Control Unit

The FBI Laboratory's focal point for evidence services is its Evidence Control Unit (ECU). The ECU's mission is to provide quality service to its evidence contributors as well as to provide supporting services to all evidence-examining units within the Laboratory.



*An ECU Request Coordinator assists an Indian Country Evidence Task Force member with evidence matters.*

As the FBI Laboratory's central point for the administrative management of evidence, the ECU acts as a liaison between FBI Laboratory staff and contributing agencies to provide information regarding the status of their cases. This best practice is demonstrated in major and high-profile cases where a single point of contact in the ECU coordinates all evidence received and provides real-time status checks to contributors, as well as to Laboratory management, as the case moves through the FBI Laboratory.

Special programs also are in place to benefit and support frequent contributors of evidence to the FBI Laboratory. The District of Columbia's Washington Metropolitan Police Department and the Indian Country jurisdictions represent two such contributors. The FBI Laboratory employs a task-force-like approach to process the large number of cases received in these matters. The ECU supports these major evidence programs by designating a "Request Coordinator" to coordinate, track, and administratively manage the evidence received. This service enables the contributing agency to discuss and exchange information regarding cases, discuss the various forensic services available, and obtain up-to-the-minute case status.



*An ECU Request Coordinator assists a local contributor with an evidence submission.*



As a service to FBI field offices, the ECU provides leadership and guidance to field evidence technicians regarding the proper handling of evidence through its Field Evidence Program. The FBI's Field Evidence Program Manager sets policy and provides to FBI field offices—as well as other federal, state, and local law enforcement agencies—guidance and direction in the receipt, storage, packaging, and proper transfer of evidence. As mandated by the Code of Federal Regulations under the Department of Transportation, the Field Evidence Program sponsors training in packaging and shipping hazardous materials. Evidence technicians responsible for packaging or shipping hazardous materials are required to receive this training every two years from a school certified by the U.S. Department of Transportation's Transportation Safety Institute.

The ECU's role in carrying out these administrative evidence services is vital to developing and fostering relationships and communication with the law enforcement community and significantly aids in the timely movement of evidence throughout the FBI Laboratory.

## **Facility Services Unit**

The Facility Services Unit (FSU) handles facility, physical security, and health and safety matters in the Laboratory building and other facilities used by the Laboratory Division.

The Facilities group comprises mostly maintenance personnel. These employees maintain, repair, and alter Laboratory Division facilities and also provide oversight for contracts that cover maintenance, repair, or alteration of the facilities. The group also oversees space-management issues and coordinates with architectural and engineering firms for facility studies and designs.

Electronics technicians (ETs) maintain and modify the Laboratory's electronic systems, including internal and external local area networks, access and intrusion systems, internal telephone communications equipment, and video teleconferencing equipment. ETs also help establish secret and top-secret communication to meet the Laboratory's needs for access to military and other government sites throughout the world.

The Health and Safety Group (HSG) ensures compliance with federal, state, and local occupational, environmental, nuclear, and transportation regulations in the operation of a forensic laboratory. This group supports investigative efforts with local, state, and international law enforcement agencies through the application and receipt of special permits for the movement of hazardous materials into and out of the Laboratory, while sharing technical health and safety information with local and state forensic laboratories. This group also manages the Laboratory's fitness center and arranges for inspections of the Laboratory's food-service facility. Finally, the HSG is home to the Health Services Office, staffed by contract nurses responsible for daily medical visits as well as routine fitness-for-duty physicals and physicals for personnel who deploy throughout the world to support FBI investigations.

## **Planning and Budget Unit**

The Planning and Budget Unit (PBU) manages all phases of planning, budgeting, acquisition, project management, auditing, and inventory and supply services for the FBI Laboratory. These essential services support the Laboratory's mission and the FBI's strategic planning efforts. Using state-of-the-art tools that include real-time, web-based financial and project management information and automated templates and reports, the PBU ensures that Laboratory investments are well planned, fully funded, successfully implemented, and appropriately managed.

During 2006 the PBU enhanced the web-based financial system used to capture, track, and manage Laboratory investments. These enhancements included spending-plan forecasting and additional project management tools. These improvements help Laboratory managers plan their financial investments and track the health, status, and completion of their projects. Project management standards were refined to integrate the best practices of investment management and ensure project excellence and success. The PBU also established the Major Acquisition Review Committee and the Research Council to serve as standardized review mechanisms for approving, managing, and controlling Laboratory projects to ensure their compliance with project management standards. During the year the PBU processed more than 6800 financial transactions and managed expenditures totaling \$66 million.

## **Security Team**

Security represents an essential component of every FBI division, and the Laboratory has some of the strictest security measures of any FBI facility. To ensure that security remains a top priority, in 2006 the Security Team, which previously had been part of the Administrative and Security Unit, became a separate entity, reporting directly to the Deputy Assistant Director of the Operational Support Branch.

The Security Team administers the many aspects of the Laboratory's security program. These include classification issues, communications security, briefings and debriefings, access requests, five-year reinvestigations and associated personnel security interviews, international travel, contacts with foreign nationals, the foreign-national visitor program, requests for sensitive compartmented information (SCI) clearances and associated briefings, security compliance issues, and SCI facility accreditation and compliance procedures.

In addition to providing continuing advice to Laboratory employees on security-related issues, in 2006 the Security Team accomplished the following objectives:

- Created a Security Awareness Program, with an accompanying bimonthly security awareness newsletter to provide reference material and advice to all Laboratory employees.
- Automated the Security Awareness Annual Briefings to allow employees to access them on the team's intranet site.
- Created databases to track and ensure compliance with the rules for unescorted visitor access, contractor access, and international travel.
- Enhanced the Laboratory's physical security by changing procedures that affect the physical surveillance of the Laboratory facility.
- Wrote a new Continuity of Operations Plan for the Laboratory and facilitated an exercise to ensure that the Laboratory continues to fulfill its mission, even in times of crisis.

## **INNOVARi: The FBI Laboratory's Business Process Management Initiative**



In 2006 the FBI Laboratory embarked on an ambitious project to improve its forensic examination business processes and to create a work-flow and information management system. The project is called INNOVARi, from the Latin word *innōvare*, meaning “to renew.” Its purpose is to provide visibility into the work activities being performed, to manage the information that is collected and produced as a result of forensic examinations, and to track and manage the individual items of evidence that are examined by the FBI Laboratory. INNOVARi provides the traditional features of a Laboratory Information Management System (LIMS), but because of the integrated work-flow features that enable the oversight and management of the entire forensic examination process, it exceeds the functionality of a LIMS.

The FBI Laboratory uses business process management, or BPM, for its INNOVARi project because BPM provides a holistic approach to improve the performance of organizations. BPM uses a methodology to analyze an organization's business processes to identify inefficiencies and uses information technology or automation to enable performance improvements. Furthermore, BPM is considered an instrument used within change efforts or interventions as part of the management discipline of Organization Development. The methodology used as part of INNOVARi is called Value Stream Management, and the automation software used to manage the business processes is called BizFlow.

As a part of its project to help create and develop its work-flow and information management system, the FBI Laboratory deployed a pilot phase involving two of its forensic business units: the Trace Evidence Unit and the Evidence Control Unit. Ten business processes between the two units were modeled, analyzed, improved, and then automated into the INNOVARi application. Overall user feedback regarding the INNOVARi application has been positive, and wider adoption is planned. Over the next two years, the remaining forensic examination units will undergo BPM methodology facilitation, and their business processes will be integrated into the INNOVARi application.



## Quality Services

The FBI Laboratory is committed to the forensic community by not only examining evidence but also providing guidance on quality assurance issues and offering training opportunities and literary resources to assist law enforcement personnel in performing their job duties. The Laboratory maintains its accreditation with the American Society of Crime Laboratory Directors/Laboratory Accreditation Board (ASCLD/LAB) and thus continues to offer unparalleled quality services. This section outlines the Laboratory's commitment in these areas.

### Quality Assurance and Training Unit

In the Quality Assurance and Training Unit (QATU), three groups work cohesively to provide for the betterment of the forensic sciences. QA staff members ensure that the Laboratory maintains compliance with the ASCLD/LAB accreditation requirements. The Training group organizes specialized classes in many areas of forensic analysis. The third group is the Library, whose personnel provide timely technical information to law enforcement and forensic science personnel both inside and outside the FBI. The Library maintains a diverse assortment of reference materials and also produces several forensic science publications.

#### Quality Assurance

QA personnel support the caseworking units of the FBI Laboratory by providing guidance on the quality system. QA staff created the *Quality Assurance Manual* and the *Laboratory Operations Manual*, which serve as the core of the quality system. Both manuals were revised in 2006 for compliance with the ASCLD/LAB-*International* Accreditation Program for which the Laboratory will undergo assessment in 2007. QA personnel also coordinate the calibration and maintenance of the many items of analytical equipment used in the Laboratory. QA staff members also manage the Proficiency Testing Program for the caseworking units of the Laboratory. Proficiency tests represent an essential requirement for maintaining accreditation as well as ensuring that forensic scientists remain proficient in their analytical abilities. Additionally, the QA staff performs audits to verify that Laboratory personnel are following established policies and procedures.

#### Training

The Training staff of QATU organizes the Specialized Forensic Science Training Program, which offers forensic science courses to Laboratory employees as well as law enforcement personnel. In addition, Training personnel facilitate scientific working group (SWG) meetings by scouting locations for the meetings and coordinating travel arrangements through FBI field offices for attendees. SWGs comprise members of the forensic community who meet regularly to discuss issues within a forensic discipline and initiate improvements for the types of analyses performed by those attending.

An integral part of the QATU's Training sector is the planning of the annual Crime Laboratory Development Symposium. This conference provides training for the managers of federal, state, and local forensic laboratories. It also serves as a forum for exchanging ideas and solutions to problems that many laboratories encounter.

## Library

The FBI Laboratory Library provides scientific literature and reference services to Laboratory personnel as well as state and local forensic scientists. Informational sources are provided as electronic resources, monographs, print journals, and other documents that support evidence examinations, prepare examiners for courtroom testimony, and facilitate the research and development of techniques used in forensic analyses. The Library currently maintains more than 8000 scientific books and 400 periodical subscriptions.

Library staff members also produce several publications that are available to members of the law enforcement community in print and on the Internet. The Laboratory's online, peer-reviewed forensic science journal, *Forensic Science Communications*, includes research papers, technical articles, case studies, and other information of interest to forensic science and law enforcement professionals. The *Handbook of Forensic Services* offers guidelines and protocols for the collection, preservation, packaging, and shipment of evidence to the Laboratory. Other publications produced by Library staff include the *Processing Guide for Developing Latent Prints* and the FBI Laboratory's annual report.

## Annual Crime Laboratory Development Symposium

The 34th Annual Crime Laboratory Development Symposium was held May 8–11, 2006, in Atlanta, Georgia, at the Georgia Tech College of Management, in association with the Carlson School of Management from the University of Minnesota. More than 240 managers and laboratory directors attended workshops devoted to the symposium's "Organizational Communication" theme. Presenters included educator and author Dr. Marshall Goldsmith; Bill Jefferies, who specializes in human and organizational behavior; David Maxfield, an expert in personality theory and interpersonal skill development; and Associate Professor of Literature at Georgia State University Dr. Paul Voss. Attendees had the opportunity to interact with other members of the forensic community and took away a greater understanding of how to communicate with their colleagues.



David Maxfield presents "Crucial Conversations" at the 34th Annual Crime Laboratory Development Symposium.



## Community Service

Perhaps more than any other profession, law enforcement has a built-in service component. Employees know that they serve their communities every day. And, yet, they always strive to do more. FBI Laboratory employees are involved in several community service projects to reach out to the local community and beyond.

### School-Supply Drive

Returning to school after summer vacation may not be a treat for the kids, but at the FBI Laboratory, the start of the new school year is fun. Staff members relive their own school days by purchasing their favorite school supplies and donating them to the local school system. Every year, this donation of backpacks, paper, pencils, markers, and other items helps the students start their school year off right.

### Holiday Food Drive

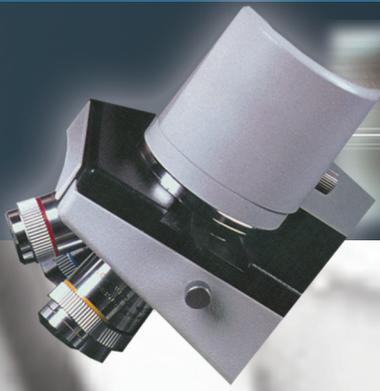
In its 2006 holiday food drive to benefit the local food bank, the FBI Laboratory collected 303 pounds of food, enough to provide approximately 228 meals for families in need. The donations went to the Fredericksburg Area Food Bank, which provides meals to residents in Fredericksburg and the surrounding counties of Caroline, King George, Stafford, and Spotsylvania.

### Junior Scientist Program

FBI Laboratory staff nurture budding scientists in the Laboratory's Junior Scientist Program. Twice a month, volunteers from the Laboratory visit a local elementary school to present topics relevant to the students' science curriculum. The students also receive information and guidance on conducting research and presenting the findings in the school's yearly science fair, which is judged by FBI Laboratory volunteers. The program culminates in a graduation ceremony at the FBI Laboratory.



*Junior Scientists visiting the Laboratory*



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